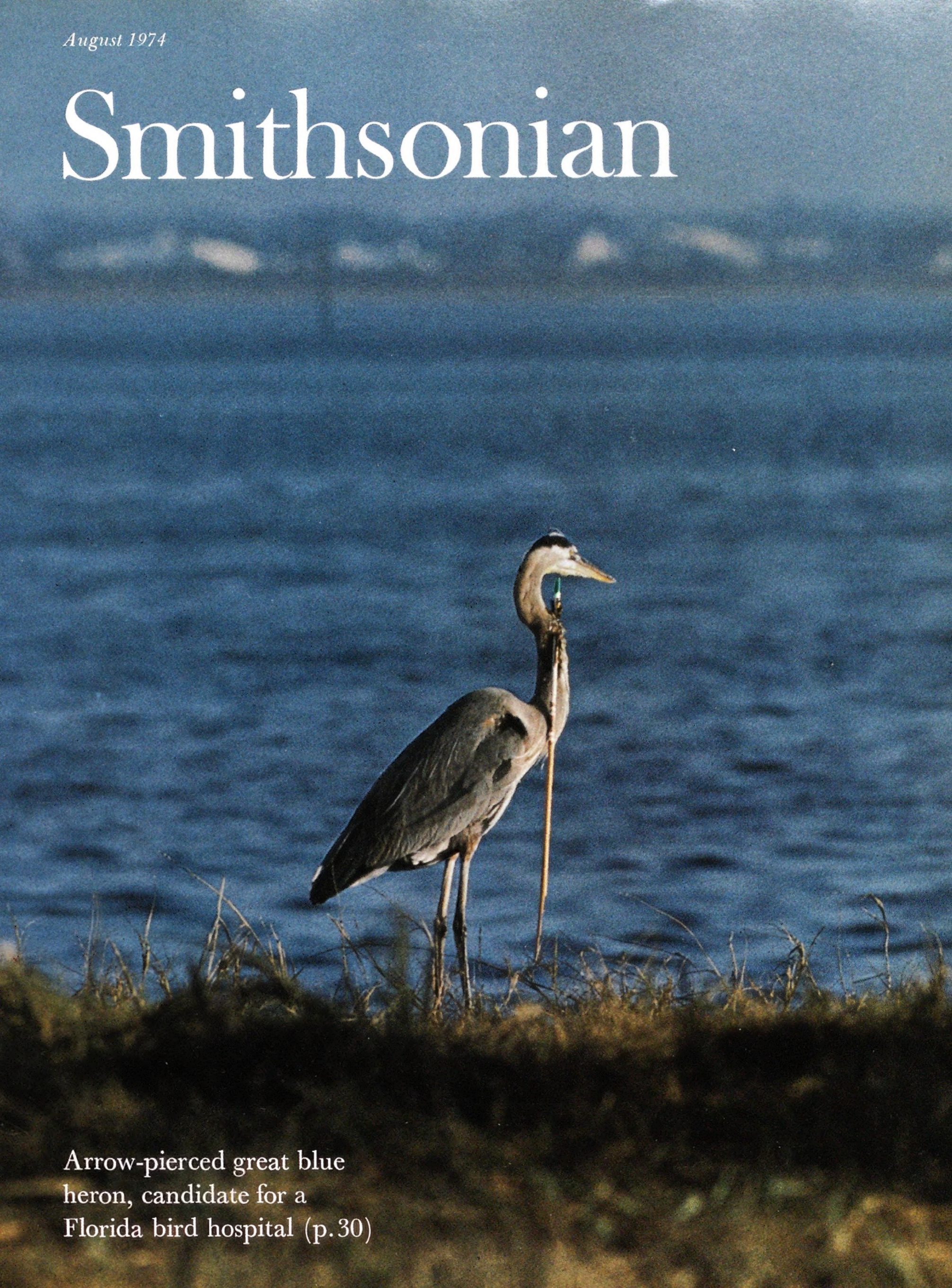
August 1974

Smithsonian



Arrow-pierced great blue heron, candidate for a Florida bird hospital (p. 30)

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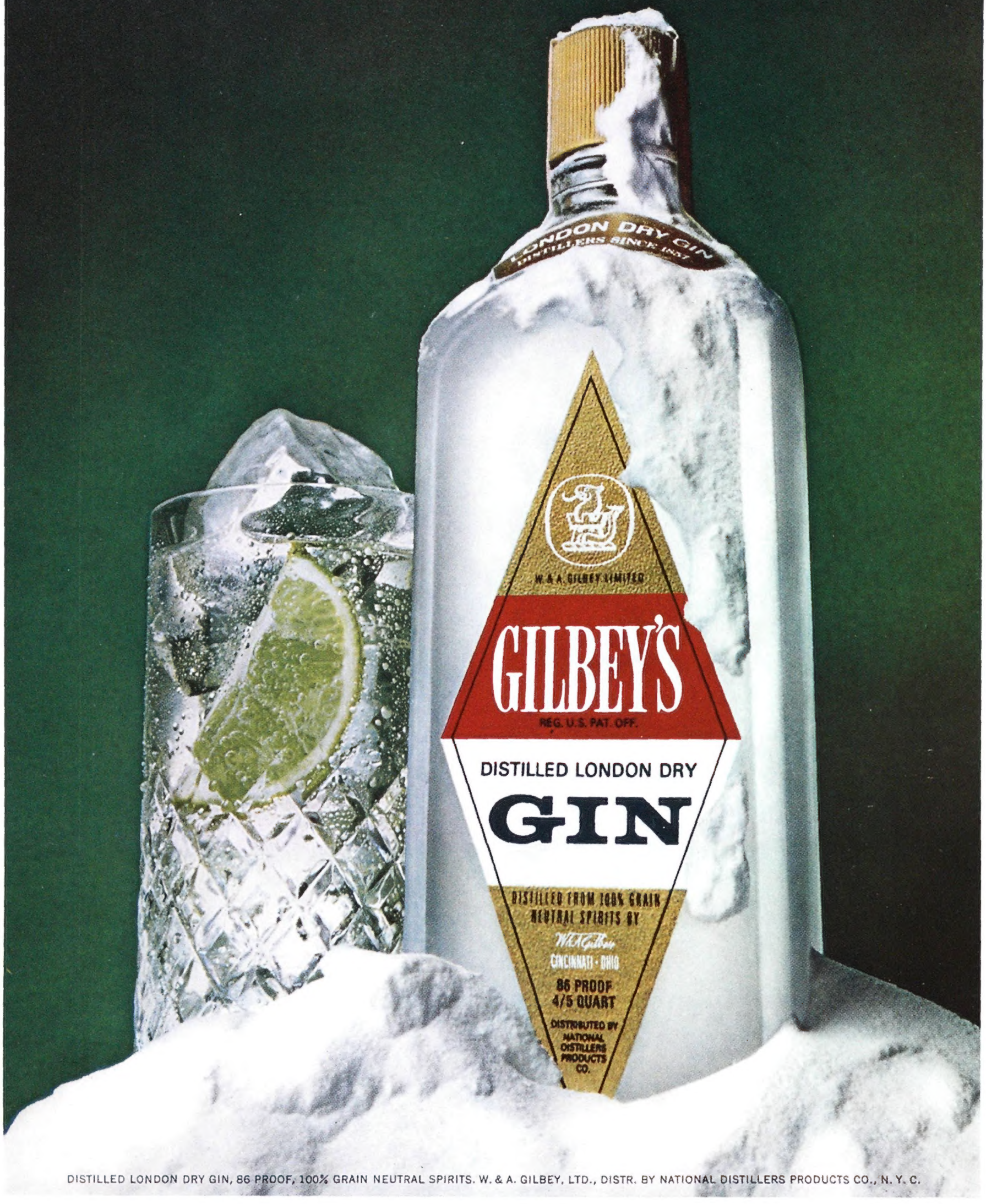

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The view from the castle

Smithsonian solar research promises new insights into how the sun affects both our health and the weather here on Earth

Smithsonian studies of the sun date back to Samuel P. Langley, the third Secretary, who in 1890 set up the Institution's Astrophysical Observatory. The work was continued by his assistant and eventual fifth Secretary, Charles Greeley Abbot, who in 1902 began measuring total solar radiation reaching Washington. Today, Smithsonian efforts in solar physics have broadened in two directions which bear directly on Man's welfare as well as on his understanding of the universe.

As I have described before (SMITHSONIAN, January 1971), one of these is taking place in the Radiation Biology Laboratory, which is unique in the world in monitoring low levels of ultraviolet radiation in sunlight. These measurements are being made as far apart as Alaska and Panama. To the medical profession these wavelengths are of great interest in the study of skin damage, from sunburn to cancer.

The other is being pursued at the Center for Astrophysics, which we operate in conjunction with Harvard University at Cambridge, Massachusetts. Here solar research derives from the theoretical work of a group studying the structure of the atmosphere of the sun and kindred stars, as well as from the Solar Satellite Project of the Harvard College Observatory. The satellite project has flown many space experiments, with the most spectacular results coming from an ultraviolet spectrometer carried on the Skylab mission. Under Professor R.W. Noyes of the Smithsonian and Harvard, observations from space promise to revolutionize our understanding of solar science.

The study of the sun is of growing importance for three reasons. First, the interaction of solar phenomena with the Earth and ourselves becomes more critical in an era of environmental awareness. While we take for granted the sun's constant flow of energy, aptly named the "solar constant," there are huge fluctuations at ultraviolet and X-ray wavelengths. In the upper atmosphere and magnetosphere there is evidence that violent changes are caused by these variations. It now appears that correlations may be provable between solar activity and terrestrial weather. Recently NASA sponsored a symposium on the subject; it was dedicated to Dr. Abbot, who found a number of unexplained correlations between events on the sun and weather on Earth.

Second, the sun is of considerable importance in current attempts to understand how electrically conducting gases (plasmas) and magnetic fields interact. These studies may lead to new ways of producing electrical power by controlling thermonuclear fusion.

Third, studies of the sun open ever-widening windows on the universe, where phenomena similar to those on the sun occur on a far grander scale. Many of these incredible phenomena—cosmic rays, X-ray stars, violent galactic explosions—can be studied in the sun on a smaller scale and at a closer distance.

The Smithsonian's basic research of more than 80 years is now beginning to point toward a real understanding of the workings of the sun and its effect on our natural environment. In 1977-1979 the sun will pass through a peak of activity (*e.g.*, more sunspots and more flares). During this period we hope to increase our study of violent phenomena on the sun, in order to gain new insights into weather as well as related events elsewhere in the universe.

S. Dillon Ripley

THREE VITAL KINDS OF CONSISTENCY TO LOOK FOR IN A PIANO.

Begin testing a piano's action (or keyboard mechanism) by playing with a variety of touch and pressure (try loud "attacks," smooth passages, short crisp notes, etc.).

Be sure one key doesn't feel noticeably lighter or heavier to the touch than another (inconsistent action).

Try moving the keys from side to side. Too much sideways movement is a sign of poor workmanship.

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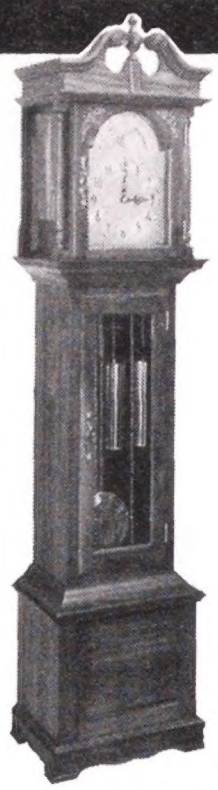

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Phenomena, comment and notes

The need to desalinate highways, the potential of fungus power, Z-ray study and a turtle returns

There is good news: It comes in the form of a single ridley. You will be forgiven if you do not know what a ridley is, since, for a long time, there have been all too few of them. Ridleys are one of several kinds of large seagoing turtles. Like other sea turtles, ridleys have been relentlessly hunted for their meat and their eggs. Like the other kinds, ridleys perform extraordinary feats of navigation which still elude human understanding; they leave the beach where they hatched and travel vast distances in the ocean, returning to their birthplace to lay eggs.

One place where ridleys used to return in great numbers was Padre Island, off Texas, but the island had been void of turtles for decades when, in 1966, 79 young ridleys were released there as part of a restocking effort.

It takes about eight years for a ridley to become sexually mature and of course it is just eight years since the 79 ridleys left Padre Island. And, according to the Smithsonian's Center for Short-lived Phenomena, a lone female ridley hauled herself up onto the south beach on Padre Island on May 13, 1974, deposited 117 eggs in the sand, received a tag from the Texas Parks and Wildlife Department, and headed back to sea. Was this one of the original 79? There's no way of telling, but if she was, there may be more next year. In 1967, 1,102 ridleys were hatched on Padre Island and released.

Water, water . . .

It seems that about six percent of all the salt produced in the world is being spread on U.S. roads each winter to melt snow and ice. Ian Nisbet, in *Technology Review,* reports that one effect of this salt is, as most drivers know, corrosion of automobiles—to the tune of $50 to $200 per car per year. But that frankly is not what bothers Mr. Nisbet, who is an environmentalist as well as a physicist.

A lot of the salt ends up in drinking water, he says, especially in areas with shallow soil and lots of roads. There are few reliable measurements, but Nisbet estimates that in the north central United States, the human contribution of chlorides to groundwater may be as much as ten times the natural contribution.

What to do? Nisbet sees no way of solving the entire problem of U.S. "overdependence on the automobile."

You are supposed to stay cool in the face of such pollution alerts these days; there has been so much doom and gloom bruited about. But, when you hear—all

Onlookers celebrate a turtle's progress at Padre Island, Texas.

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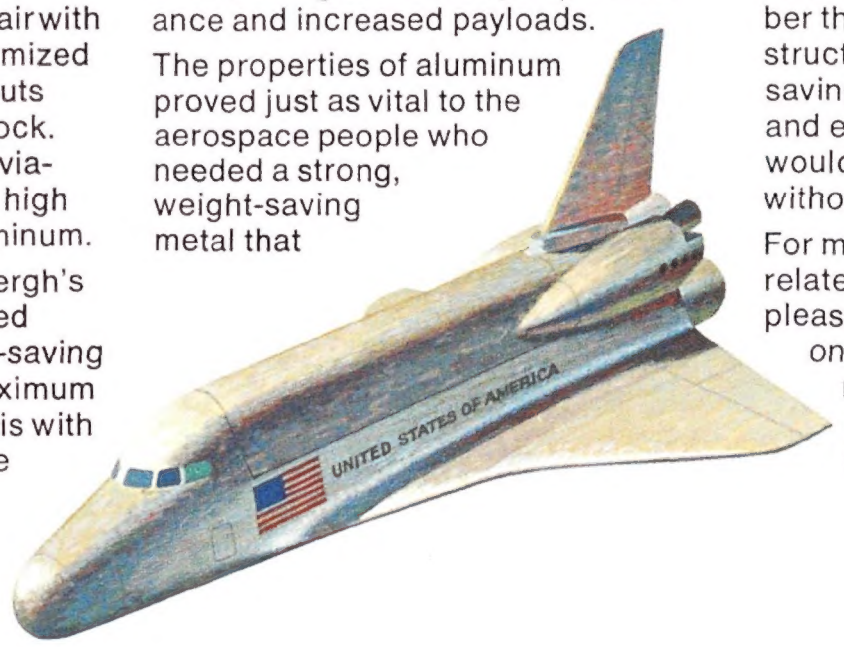
Every airplane buff knows that the Wright Brothers flew 120 feet at Kittyhawk. They conquered the air with a contraption that used a customized motorcycle engine, wooden struts and a cast aluminum engine block. Even in the very early days of aviation, designers knew about the high strength-to-weight ratio of aluminum.

Subsequent planes, like Lindbergh's *Spirit of St. Louis,* were designed with more sophisticated weight-saving principles in order to make maximum use of fuel. Lindy landed in Paris with over eight hours of fuel to spare —an excess that was partly a result of aluminum's weight-saving properties.

And in commercial aviation—where every pound of weight saved in a jetliner equals a substantial savings in fuel and money—aluminum is contributing to economy of performance and increased payloads.

The properties of aluminum proved just as vital to the aerospace people who needed a strong, weight-saving metal that could endure the stresses of leaving the atmosphere. Which is why aluminum was used as the principal structure of the awesome *Saturn* booster and the *Lunar Module* and will be used on the *Space Shuttle.*



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in one month—that the drinking water is turning salty and the rain is turning acid, you cannot help getting a certain sense of apocalypse.

Two ecologists have announced (in *Science*) that the rain over the Northeast has become significantly more acidic in the last 20 years. The average pH level now is 4, with some rainstorms as bad as 2.1. To get an idea of what that means, the two ecologists point out that pine needles innoculated with a sulfuric acid solution of pH 4 or lower grow only half as long as normal. The overall ecological effects of acid rain are not known in detail, but it seems fairly clear that plants, aquatic ecosystems including fish, not to mention buildings and statues, and presumably people, are all worse off when bathed in acid rain.

The source of the acid, say the two ecologists, is the burning of fossil fuels other than coal (which was going out of style in the 1950s) and the reduction of coal's particulate emissions—that is, soot—which tended to neutralize oxide emissions in the atmosphere. So now, though the Northeast is relatively sootless, sulfur oxides and nitric oxides escape into the atmosphere and return in the rain. Sometimes there seems no way out.

Watch out for Z-rays

Without the fanfare that so often attends a scientific breakthrough, the Center for Astrophysics (operated jointly by Harvard and the Smithsonian Institution) has announced the discovery of a new astronomical phenomenon. The announcement appeared in No. 97 of the Center's preprint series. The report begins:

"For several years, attempts have been made to detect a new type of radiation in space (known as Z-radiation), but because detection equipment was below the required threshold . . . and because the rapid accelerations of rocket flights prevented graduate students in the nose cones from recording good data, this has not hitherto been achieved. We now report the first positive identification of celestial Z-radiation."

The paper goes on to say that one of 312 detectors on an Earth Resources Satellite designed to monitor Peruvian guano birds detected a single one-second burst of Z-radiation in the vicinity of Taurus. Larry S. Liebovitch, who wrote the report, suggests that, though there was only one such burst, advanced statistical and astrophysical techniques permit him to say that the source is a black hole and to postulate the existence of some 3×10^{18} other such Z-sources. To find them, he says, a proposal is on its way to NASA to wire the entire state of Massachusetts with Z-detectors and launch it into orbit. "It is expected," the report concludes, "that there will be strong governmental support for this project."

Shoo, bird!

A solution may be at hand for people distressed at having migrating birds crash into their picture windows and die of broken necks. Like most creatures, birds will not willingly approach an enemy—and falcons are enemies of many birds. But where do you get a falcon? Studies of bird perception suggest that all it may take for a bird to see a "falcon" is to see its silhouette. So recently the Smithsonian's Secretary, S. Dillon Ripley, designed the silhouette of a diving falcon which can be affixed to a picture window. Mr. Ripley donated the design to a manufacturer who sells the decal silhouettes, called "Shoo Birds," through the various shops of the Smithsonian for $1.50 each.

Falconlike silhouette of the "Shoo Bird."

Elsewhere, in one of the Smithsonian's more far-flung installations, there has

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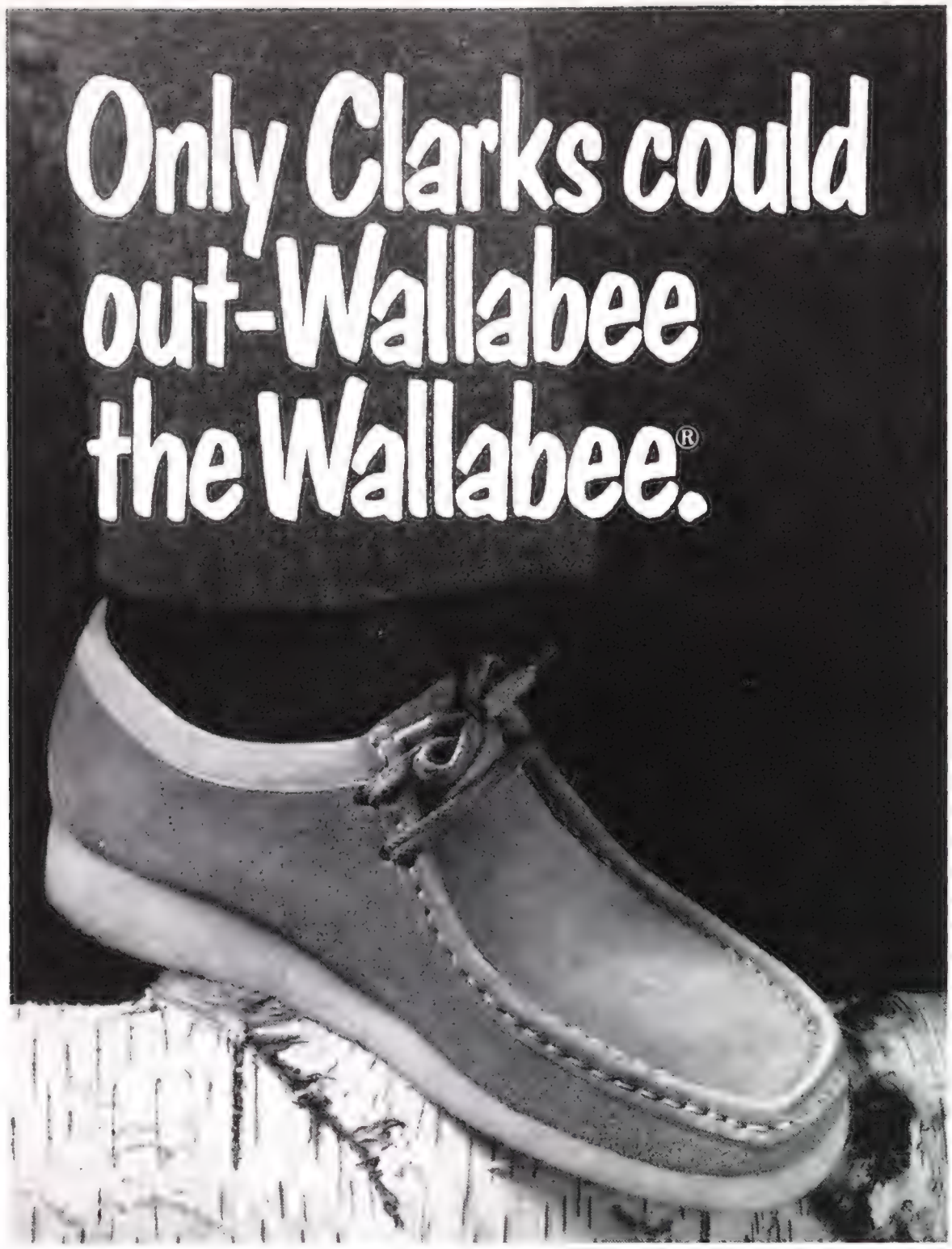

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been a less common bird problem. The Smithsonian Astrophysical Observatory operates a reflector—some 10 meters wide and consisting of 248 mirrors—on Mt. Hopkins in Arizona. Resembling a concave, compound eye, the reflector searches for celestial sources of gamma rays.

Recently an engineer noticed unusual scratches on the ground-level mirrors. Later he observed a roadrunner sunning itself by one of the reflector's anchor pads. Soon the bird noticed another roadrunner staring at it and was apparently outraged, attacking the interloper and pecking scratches into the glass. Now the staff routinely shoos roadrunners away whenever they are seen. Perhaps a black silhouette of that harebrained coyote from the movie cartoons. . . .

Fungus power

The world contains an enormous bank of energy in a constantly renewing account, but it is hard to tap it. The power is solar energy (see p. 4) and the bank is plants—in particular, cellulose, the stuff of which plant-cell walls consist. So far, the best way to get at all that energy is to burn it (wood) or to eat it (food plants). But cellulose can be broken down by a process called hydrolysis into glucose, and from glucose Man can make all sorts of things, including chemical raw materials, proteins and fuel (ethanol). The problem is that hydrolyzing cellulose on any large scale has been what *Chemical and Engineering News* calls inconvenient.

It turns out that the U.S. Army has taken up the challenge. During World War II in the South Pacific the army was waging war not only against the Japanese but against a fungus called *Trichoderma viride,* an adept cellulose-converter (which of course is just what you don't want around such installations as barracks).

Being of long memory, the army has now run successful laboratory tests in Natick, Massachusetts, using the fungus' enzymatic action to turn such things as newspapers and other municipal detritus, straw and peanut wastes into glucose. Plans are afoot to build a pilot plant capable of handling 200,000 pounds of cellulose a month, and army spokesmen think that *Trichoderma* plants could be operating on a very large scale by 1980.

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Letters to the Editor

Texas Longhorns

Dear Sir: Your article in the June issue on the Texas Longhorns, by David Snell, was most interesting. I thought they had all but vanished. I crisscrossed Texas a few years ago and the only real Texas Longhorn I saw was in San Antonio—mounted.

Since most Americans have never seen a Longhorn, the National Zoo could delight visitors by acquiring one.

Karl D. Vass
Falls Church, Virginia

Dear Sir: During my stay in this country, I have traveled as much as I could to see Herefords, Brahmans and a lot of other breeds of cattle, but I never got to see any Longhorns. I do have a set of mounted horns on the living room wall, which a friend of mine in Texas bought for me.

This summer my family and I are going on a trip around the United States, and we plan to spend some time in Texas. I hope to import some Longhorn calves upon my return to Sweden next year, when I will be a part-time farmer. Of course, the calves will have to be kept in a closed barn during the winter.

Carl-Olaf Janér
Agricultural attaché
Swedish Embassy
Washington, D.C.

The oceans

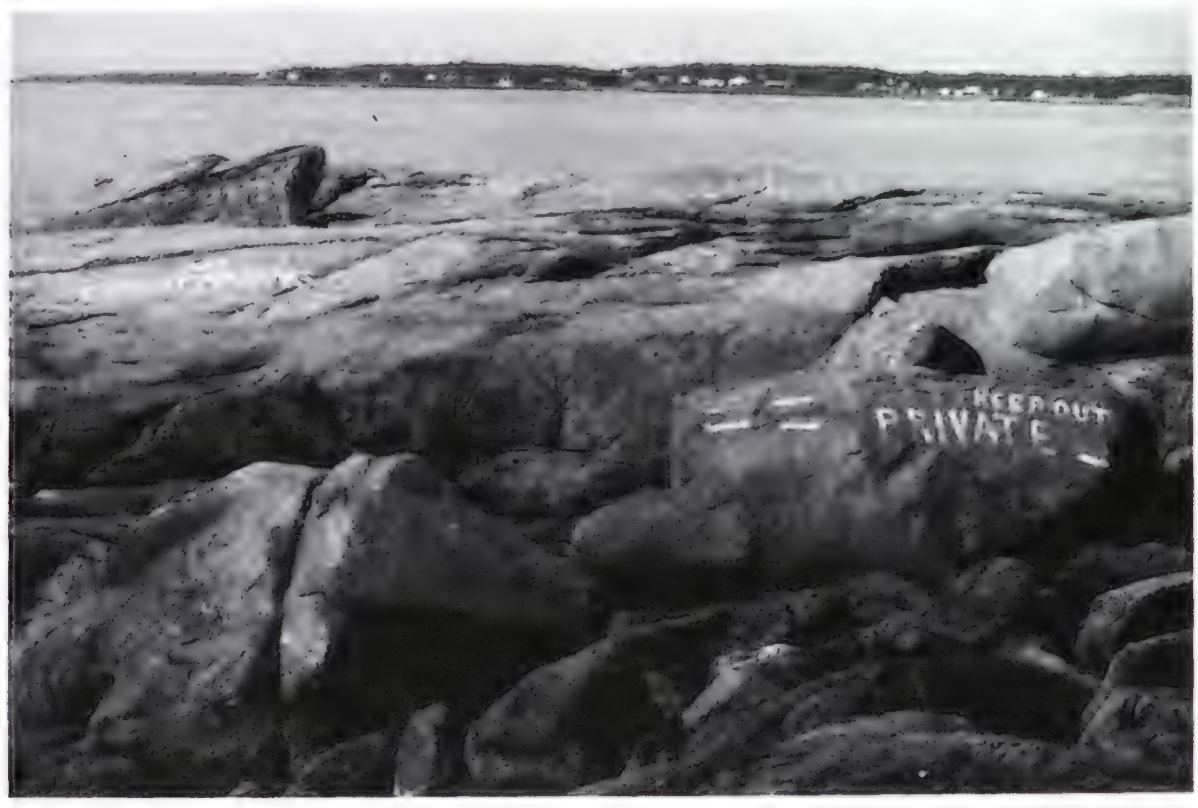
Dear Sir: In his myth-shattering article on the oceans, Wesley Marx states that only two percent of the U.S. coastline is in public ownership.

Some of the fortunate ones who possess the other 98 percent are not satisfied with simply keeping the rest of us out, but insist on spoiling the few natural vistas to which we have access, as evinced by this view of the coastline near York, Maine (see below).

Daniel J. O'Connor
Roslindale, Massachusetts

Dear Sir: Although I do not agree with all of Mr. Marx's opinions, I found it a thought-provoking analysis. However, there are a couple of corrections I should like to call to your attention.

Your opening photograph is of an



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ocean-going tuna clipper hauling in its purse-seine net, not a bait-fishing operation. The fish in the net are frigate mackerel, not tuna baitfish, and the fishermen are cleaning the net of this species since it has little or no commercial value.

Your black-and-white photograph shows the Coast Guard cutter *Storis* taking into custody the Soviet factory ship *Lamut* (not a trawler). In the same incident (not shown in your photograph), the Soviet trawler *Kolyvan* was taken into custody. These ships had been illegally conducting fishery support activities—*i.e.*, the *Kolyvan* was transferring its catch to the *Lamut*, within our 12-mile zone off Alaska. The Soviet vessels were fined a quarter of a million dollars.

Robert W. Schoning, Director
National Marine Fisheries Service
U.S. Department of Commerce
Washington, D.C.

Dear Sir: For decades, people have considered fish to be inexhaustible, but that is no more the case than it was with the passenger pigeon. Now, with the high price of meat, people have turned to fish, assuming they are as plentiful as ever.

If consumers become aware that many species of fish are in danger of disappearing, they might be educated to substitute vegetable proteins, such as beans, peanuts and grains.

Helen Webb
Harpers Ferry, West Virginia

Dear Sir: It seems to me unforgivable to mention the Law of the Sea Conference without once referring to the United Nations. Had it not been for United Nations Ambassador Arvid Pardo of Malta and his forethought in 1967, the idea of the conference might never have been conceived. Had it not been for a United Nations General Assembly resolution in 1970, this particular conference would not be taking place.

Patricia K. Di Giorgio
Margaret Leahy-Zendejas
United Nations Association
San Francisco, California

Dear Sir: In Wesley Marx's otherwise excellent article, there was no mention of the pollution of all our oceans and seas by tankers and supertankers that have had a devastating effect on all forms of sea life from plankton to whales.

Normal leakage, illegal pumping of

bilges and oil spills from damaged hulls of these ever bigger and ever more numerous tankers have not only done possibly permanent damage to our oceans but have also despoiled the world's shorelines on a level with natural disasters.
William Pain
New York City

Cincinnati terminal

Dear Sir: Gregory Thorp's article on the Cincinnati Union Terminal brought back a flood of memories. My father was first, last and always a railroad man. He started at the bottom, working on a section gang, and finally became an independent railroad contractor. His formal education consisted of four years in a rural Mississippi two-room school.

He knew before he died that the golden age of the railroad was over, but the end of the Cincinnati Union Terminal would have been a special sadness for him. He had the contract to put in the railyard and also to expand it during those hectic World War II peak years.

They don't make men like Bob Colly anymore, or super railroad terminals like the Cincinnati Union.
Mrs. Sue Colly Kreidler
McAllen, Texas

Audubon review

Dear Sir: I was horrified at the portrait of Audubon which emerged from your book review of Kathryn Hall Proby's *Audubon in Florida.*

I am left sickened, repelled and disgusted by such information in the review as this: "[Audubon] enthusiastically describes shooting numbers of pelicans and cormorants"; "Audubon and his friends hide among the bushes . . . where shorebirds are feeding. . . . In a very short time the hunters have a pile of birds the size of a 'small haycock' "; and, most repellent of all to me, "Audubon's ebullient spirit bursts forth unexpectedly when, after being mired in a salt marsh, he and his companions celebrate getting back to deep water by setting fire to the marsh. They then watch thousands of marsh rabbits run for their lives in front of the blaze."
Betty Boegehold
Bronxville, New York
The reviewer was simply reporting Audubon's own descriptions of his explorations

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in 1831-1832, and being mindful of what Alexander Sprunt IV wrote in his foreword: "Audubon has, at times, been criticized for shooting birds wherever he went. This is certainly a case of clouded hindsight. Before the days of museum collections, good binoculars, cameras, and field guides, there was simply no other way to study birds than to shoot them, and those collected by Audubon himself were a mere drop in the bucket to the general killing that was an accepted part of frontier America. Audubon's popularization of nature and particularly birds through his books and paintings has probably done more to preserve birds than any other single action." Ed.

Whiskey Rebellion

Dear Sir: In your article on the Whiskey Rebellion, I am puzzled about the drawing of U.S. dragoons escorting prisoners.

Your attention is drawn to the number of left-handed dragoons we had in the army at that time. I was always under the impression that sabers were carried in the right hand and the bridle arm was the left hand. Maybe, being an ex-Britisher, I do not understand the connotation.

William J. Mayo
Phoenix, Arizona

Inadvertently, the drawing was reversed in production. We feel pretty left-handed at not having caught it in time. Ed.

Bicentennial column

Dear Sir: Edwards Park's interesting history of Colonial Boston's problems contains one error. The British Marines did not earn the title "Royal" until 1802, when George III bestowed it. Their actions at Cape Saint Vincent, Camperdown, the Nile and at Copenhagen won them that honor.

Gen. J. P. Berkeley, U.S.M.C. (Ret.)
Norfolk, Virginia

Mr. Park, who confesses he was never either a Marine or Royal, can only say, "No excuse, Sir." Ed.

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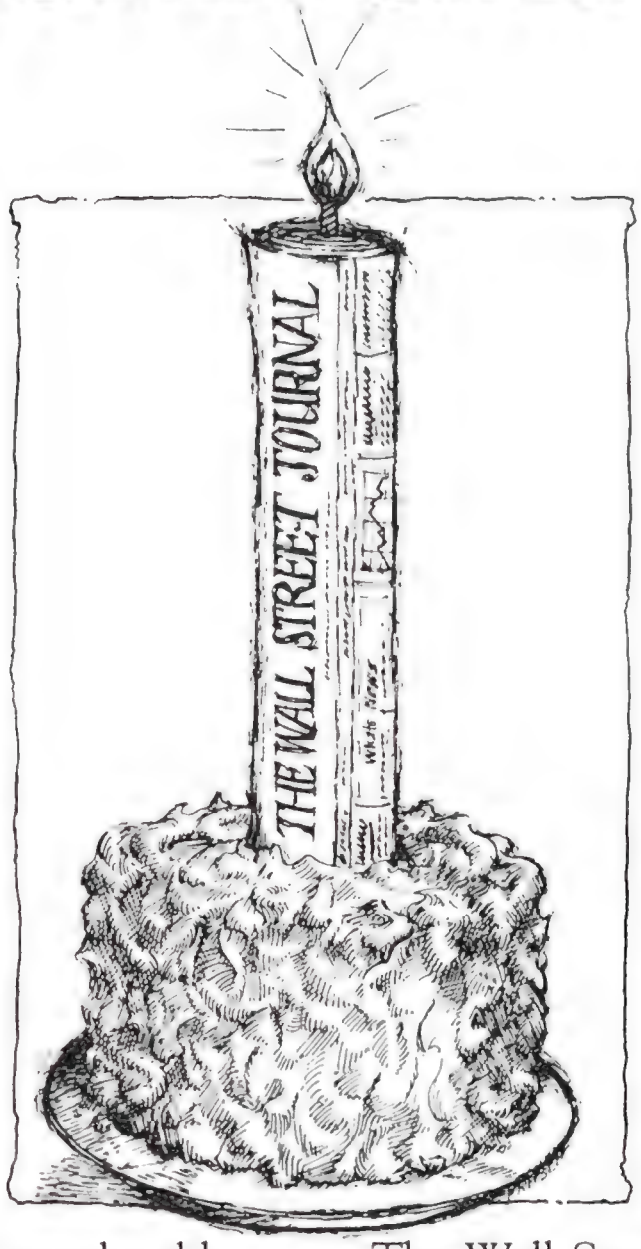

How much more are you going to know a month from now? How much new information will you have about business in general, or about *your* business? How much smarter will you be?

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AUGUST 1774

In the blaze of Virginia's summer heat, delegates from the counties are jogging toward Williamsburg to prepare for next month's congress in Philadelphia. George Washington, who has been conducting the Fairfax County assembly at Alexandria, rides south—armed with a strong, simple statement of American rights provided by his neighbor George Mason. Thomas Jefferson, coming east from Albemarle County, carries the political paper that so occupied his mind last month. It is finished: "A Summary View of the Rights of British America." It calls for a complete disavowal of British authority. Perhaps overwrought by his ideas, Jefferson suffers an attack of dysentery on the way to Williamsburg and turns back. He sends two copies of his paper to friends, one to the incendiary Patrick Henry, the other to Jefferson's aristocratic relative, Peyton Randolph.

Williamsburg throbs with excitement. Delegates clop down Duke of Gloucester Street, seeking lodgings, meeting friends at the Raleigh Tavern. As the sultry month drags on, they adopt provocative resolutions for Virginia's official stance at the congress. Washington's Fairfax County has sent up a plan to end the slave trade. It is adopted. Mason's principles are read. So are Jefferson's—thanks to cousin Peyton; Patrick Henry never glanced at them. They are too radical even for this fire-eating group.

The delegates are elected: Peyton Randolph, Richard Henry Lee, George Washington, Patrick Henry, Richard Bland, Benjamin Harrison and Edmund Pendleton. A formidable team of three lawyers and four land barons.

Delegates from two other colonies, Delaware and North Carolina, are chosen this month. Caesar Rodney, Thomas McKean and George Read will represent the former, Richard Caswell, Joseph Hewes and William Hooper the latter. All are involved in the law. Georgia has just too few people to get involved.

On the 30th of the month, Patrick Henry and Edmund Pendleton arrive at Mount Vernon to pick up Washington and ride northward. George Mason drops by for a discussion of the momentous issues over which the congress will argue in the next few weeks. Then the three delegates say good-by and set off.

Mason rides back to his estate, Gunston Hall, a sleepy, sun-drenched complex of lawns and buildings overlooking the Potomac. Its great house is beautifully designed and built, and no wonder, for its architect was the young genius William Buckland, who came to America 19 years ago as an indentured servant to George Mason's brother.

Buckland has been living for the last three years in Annapolis, where he has worked on a number of the most handsome houses in that rich and jovial little town. He is finishing what may prove to be his finest work, the house of Matthias Hammond which he began two years ago. Here Buckland, now 40, has followed the region's simple plan—central house of ample rooms linked by "hyphens" to adjoining dependencies, the brick-floored kitchen and the office. In the main house he has maintained perfect symmetry, even using false doors for his effect, yet has introduced a subtle individuality to every major room—in each a different molding, for example, and hence a different "feel."

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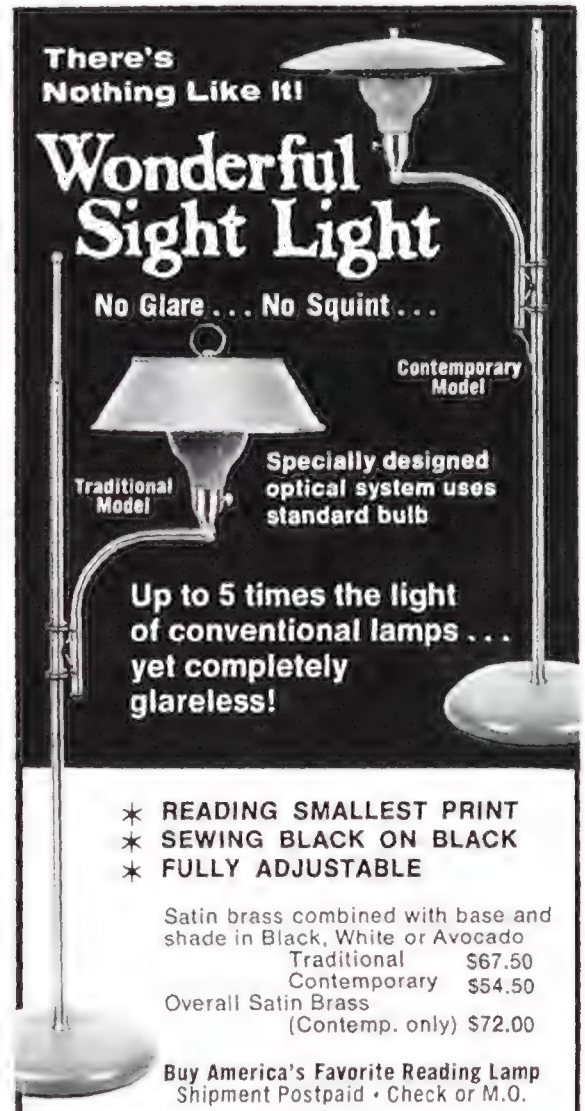

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write for nearest Sight Light stores.

The disparate moldings, then, all hand-carved, are brought together around the doorway in a sunburst of ornamentation.

Buckland is one of many American architect-builders whose work is admired even by the English, intensely proud, right now, of their splendid Georgian style. In Virginia, Richard Taliaferro, almost 70, is honored for the great houses he designed —Westover, Carter's Grove, Wilton. In the north, Peter Harrison, another aging talent, can look back with pride on his two houses of worship, Boston's King's Chapel and Newport's Touro Synagogue.

One builds a home and one furnishes it. In England, a brilliant Scot, now 42, named Robert Adam has designed interiors and matching furniture of such simple, classic grace that they are widely copied. The firm of Hepplewhite is setting a similar style in furniture, as is the designer Sheraton. Thomas Chippendale's firm is now considered a little passé.

In America, furniture-making has flourished out of necessity, for only the very rich have been able to afford English imports. Thomas Affleck and Benjamin Randolph, both working in Philadelphia, turn out elaborately carved chairs and other pieces; the Goddard-Townsend family of Newport maintain a distinctive style; Charleston's many fine firms—often depending on black cabinetmakers to do the joining and carving—furnish the town's big shaded homes where planters hide from the summer heat; in Annapolis, William Buckland's neighbor, John Shaw, does exquisite work to give his fellow townsmen places to dine and play cards.

Another Annapolitan is the artist Charles Willson Peale. Since he studied in England he has been highly sought after by planter families for the portraits that must go on the walls of the fine homes and look down on all that gleam-

ing, inlaid furniture. One of Peale's clients, two years ago, was George Washington. The Colonel had been stiff and awkward, noting in his own journal that he was then in "so sullen a mood, and now and then under the influence of Morpheus, when some critical strokes are making, that I fancy the skill of this gentleman's pencil will be put to it in describing to the world what manner of man I am."

Peale recalled of that sitting that he was "pitching the bar" one summer afternoon with some visiting young gentlemen when the Colonel showed up and, without bothering to take off his coat, threw the iron shaft far beyond the longest previous throw. "When you beat my pitch, young gentlemen," said Washington, "I'll try again." And he strolled off.

Painting is a lively art in America. The Colonists love to see their landscapes, their homes, their own family faces adorning their walls. Those who can afford portraits get them done by any of a number of professional painters.

Thus painters wander through the Colonies getting jobs and turning out portraits (or sometimes painting walls, inside or out). The best of them add up to a rather impressive catalog of American artists and most of these eventually travel to London, where the great English painters of the day, Reynolds, Gainsborough and Romney, are all active.

Benjamin West, a Philadelphian, was a professional painter at 18. A grant from an admirer sent him to Rome, then to England where King George himself became his patron. He absorbed the heroic style, and his "Death of Wolfe" three years ago made him the rage of London.

John Singleton Copley, relative of some of Boston's leading Tories, has just left for England. Perhaps his politics explains his move, for Boston is not a happy place for a Loyalist, but also his work has been lauded by Reynolds and West, and London beckons imperiously. Gilbert Stuart of Newport studied under the Scottish painter Cosmo Alexander, a follower of Reynolds. John Trumbull graduated from Harvard last year. He is young yet, but he greatly admires Copley and strives to follow him.

So, as turmoil rages on the political front, the world of art continues to turn serenely and productively.

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Photographs by Yale Joel and Philippe Halsman
Article by Meryle Secrest

Museum staff members lug full-scale Styrofoam copies of works by Bourdelle, Archipenko, Ipoustéguy and

Surrealistic view of Hirshhorn art coming to Mall

The newest Smithsonian art museum gets ready for the arrival of more than 6,000 modern works of painting and sculpture

If you had 75 large pieces of sculpture and a 350-foot-long sculpture garden in which to put them, how would you decide which work goes where? For the last several months that is the problem that the staff of the Smithsonian's newest art museum has been grappling with.

The biggest, most dazzling, most complete: These are some of the superlatives that have been applied to the collection of approximately 6,000 modern paintings and sculptures which Joseph H. Hirshhorn gave to the nation in 1966. The 75-year-old multimillionaire considers himself an art lover since he was 12, when he cut out art reproductions on calendars to place over his bed. He spent more than 40 years assembling the collection, which is currently valued at about $50 million. (For two of the masterpieces coming to Washington, see pp. 28-29.)

The Hirshhorn Museum and Sculpture Garden,

Reg Butler. The replicas were made to facilitate final placement of the real sculpture in the garden.

which is located on the south side of the Mall between the Arts and Industries Building and the new National Air and Space Museum, is scheduled to open the first week of October. Although preparations have been under way for a considerable time, the staff is working feverishly to get everything in place by opening day.

Indeed, one of the staff's chief headaches is the arrangement of the sculpture garden. As one of the exhibition designers commented, "A sculpture garden can look like a graveyard if you're not careful." When it comes to installing massive pieces of heavyweight sculpture, the penalties of error are enormous. "If you decide to move one very heavy piece of sculpture four feet to the left, you might need a crane," one staff member said.

So an ingenious solution was found: Duplicate the sculpture garden pieces full-scale in lightweight Styrofoam (above), which can be picked up and moved around easily on the site. Two young artists spent several months cooped up in a warehouse reproducing several dozen of the pieces, with results that bear a startling resemblance to the originals.

Transporting the originals to Washington is perhaps the most dramatic part of the move. Most of the large works are being brought down from the Hirshhorn estate in Greenwich, Connecticut, where they previously stood in the garden. Because the lawn would have been damaged by a crane large enough to pick up 4,000 pounds of bronze, it was decided to fly out most of the works.

"For us it is common," said Edward Monserrate, vice president of Hahn Brothers of New York, who will be overseeing the removal of the sculpture early this month. "As far as the helicopter crew is concerned, a sculpture is a piece of freight like any other." Practice flights over the garden began in June.

The Hirshhorn art move

Monserrate expects that 60 percent of the Hirshhorn sculpture at Greenwich will be moved by helicopter. The works, protected by padding, will be fitted into slings of nylon or metal cable, depending on their weight, hoisted some 50 feet into the air and deposited at a staging area or directly onto flatbed trucks, to be driven to Washington.

There, they will be installed in and around a $16-million building, designed by Gordon Bunshaft, a partner in the New York-based architectural firm of Skidmore, Owings & Merrill. Bunshaft devised a cylindrical concrete structure, with a diameter of 231 feet, and an inner circle that is open to the sky (opposite). The building (which, in plan, resembles a doughnut with an off-center hole) stands on four piers, 14 feet above a paved plaza.

Above the ground floor, which houses a glassed-in lobby, the first and second levels provide exhibition space for the permanent collection. The top floor contains administrative offices, a library and a storage area for paintings. Rest rooms, a sales shop, a gallery for temporary exhibitions and a 280-seat auditorium are on an underground level.

Each of the two gallery levels consists of two concentric rings (see scale model, opposite). The inner ring, unofficially designated as the ambulatory, will be used to display sculpture, bas-reliefs and art works that are not affected by sunlight; its tinted-glass wall overlooks a fountain in the interior court. The floor-to-ceiling windows enable spectators to look across the building and observe something that museum-goers always like to look at: other people. The outer ring is for the display of paintings; it is windowless, except for one gallery which opens on a wide balcony overlooking the sculpture garden and Mall. Because of the curvature of the walls, museum visitors are not confronted with vistas of interminable corridors, the grandiose hallways that automatically induce museum fatigue in some spectators.

At one point last spring some 280 pieces of small sculpture were placed in a storage area, lined up on shelves or arranged on small platforms or casually on the floor. There were some top-quality bronzes by Matisse and Henry Moore, some elegant nudes by Lachaise, a Giacometti or two, a Red Grooms construction and a three-foot high freestanding thumb by the French artist César; altogether, director Abram Lerner said casually, the 280 works were probably worth $5 million. The pieces, which had the look of stage props piled in the wings, wore cardboard labels attached with string. "Oh, well," Lerner said of a Carpeaux bronze bust of Dumas *fils* with a label hanging from one ear, "if he gets lost, he'll know who he is."

Lerner, 61, is a spry man with an acute sense of life's ironies who went to New York University, painted murals for the Works Progress Administration in the Thirties, taught art at Brooklyn College and was for ten years associate director of New York's A.C.A. Gallery. He became curator of the Hirshhorn Collection in 1957 and was Hirshhorn's inevitable choice for the directorship of the new museum.

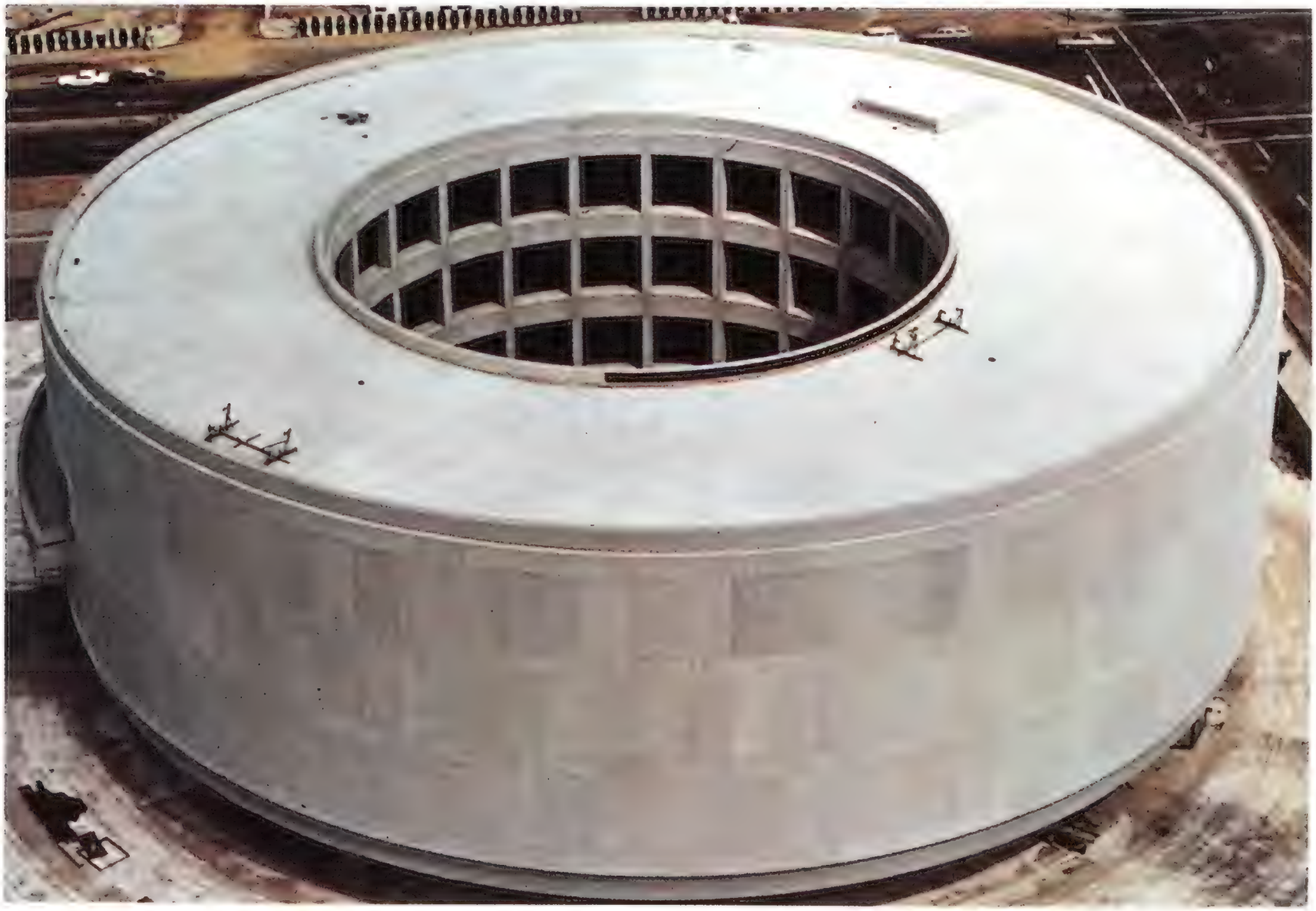
Courtyard is no place for pigeons

As preparations began in earnest this summer, Lerner was worrying about everything at once: the pigeons which had established a home somewhere inside the circular courtyard ("Once they've nested, you can't get them out"), the lack of glass in the entrance doors ("We're air-conditioning half of Washington") and even the deficiencies of the fourth-floor refrigerator ("How can we have gotten a modern refrigerator that doesn't defrost? Send it back").

Each problem was dealt with decisively. The most exciting challenge proved to be the format of the inaugural show. Lerner said, "I decided that there are two ways you could do an opening exhibition. The first would be to pick out the most smashing pictures and give them a theatrical display with lots of space. You might please a lot of people esthetically . . ." but, he implied, it would not serve the goals of James Smithson, whose wish it was that the Smithsonian Institution be responsible for "the increase & diffusion of knowledge among men."

Consequently, Lerner decided on a chronological installation. He has divided the exhibition into six epochs, beginning with the late 19th-century American and European artists, continuing through art between 1900 and 1913, from 1914 to 1929, from 1930 to 1945, from 1946 to 1959, and 1960 to the present. There is a dearth of French impressionist and cubist works, but postwar European art is well represented. The result-

Museum director Abram Lerner makes some minute adjustments in this scale model of the galleries.



The Hirshhorn building has a balcony on one side, overlooking Mall, and windows facing interior court.

ing exhibition may be too large to absorb in one visit, Lerner said, but will have the advantage of putting into clear relief the developments in American art in this, its most important century.

Planning just what will be shown, and where, has taken two years. After an ingenious scale model of the galleries was built, each painting and sculpture (about 900 works will be seen in the opening exhibition) was reproduced in scale and the shifts and balances observed with the aid of angled mirrors and an architect's periscope.

"You can't be much cleverer than we were," Lerner said, "but cleverness is not the answer, because the scale of our model had to be so reduced that later adjustments are inevitable."

The physical moving of the paintings has been least difficult. Although the Hirshhorns kept numerous paintings in their Park Avenue apartment in New York and their house in Greenwich, the bulk of the collection was in storage in a warehouse on the west side of Manhattan. Each painting had to be examined, wrapped, transported, unwrapped, examined again and crossed off the list as it arrived in Washington.

The handling of the paintings is a necessarily delicate operation. Douglas Robinson, registrar, said: "You can't pick up something and think, 'This piece is worth so many hundreds of thousands of dollars, I hope I don't trip,' because you will. You have to keep your wits about you and do one operation at a time."

Lerner conceals his concern about opening on time: "The fact is we have had a long time to prepare but when you get down to the last minute, it does you no good. The deliveries of our paintings and sculpture did not begin until May, which means we had less than four months to install the show. You do it the way you do a Broadway opening. You work until the last minute and you pray there are no sudden crises."

Styrofoam and plywood mock-ups of European and American 20th-century sculpture temporarily fill

the Hirshhorn sculpture garden, which runs parallel
to the Mall. National Archives Building is in background.

Two fabulous bronzes coming from Connecticut

Until this year, Joseph H. Hirshhorn could walk out the front door of his house in Greenwich, Connecticut, and be confronted by the *Burghers of Calais* (below). By October, the *Burghers* will be airlifted to a truck

Joseph H. Hirshhorn and his wife Olga pose before Rodin's *Burghers of Calais*, an 1880s bronze honoring six 14th-century martyrs of the besieged port city.

Alberto Giacometti's attenuated bronze *Dog* (1951), its nose lowered in the quintessential canine manner, watches over the Hirshhorn estate in Connecticut.

and Giacometti's 18-inch-high *Dog* (below) will be carefully packed for the move to Washington. When ground was broken for the new building in 1969, the Latvian-born collector declared: "This is a proud day for me. It was an honor for me to give my collection to the people of the United States. I think it's a small repayment for what this nation has done for me and others who arrived here as immigrants."

By Downs Matthews

Volunteers rescue injured wildfowl

Snagged on fishhooks or tangled in lines, wings broken or throats torn, birds find their way to an improvised sanctuary

Ralph Heath holds a one-eyed, cripple-winged pelican named Pat after actor (and donor) Pat O'Brien.

On a December day in 1971, a St. Petersburg, Florida, couple were driving along Gulf Boulevard when they saw a cormorant with a broken wing walking down the street. They took it to a veterinarian, who set the wing, and then took it home to care for it while it healed. That effort changed their lives.

The cormorant, subsequently named Maynard, was the first of more than 2,500 sick and injured birds that Ralph and Linda Heath have treated in what is now the Suncoast Seabird Sanctuary. Nearly all the birds they see are the victims of encounters with man and his oil, fishhooks, sewage, monofilament fishline, power lines and arrows (see cover). The Heaths have become experts in the ways, deliberate or inadvertent, that birds come to grief at the hands of man.

For example, a brown pelican is soaring over Tampa Bay in search of a meal. Spotting a fish, the bird wheels sharply and dives with 14-inch beak extended to seize its prey. But instead of the yielding sea, the pelican smashes headlong into a wooden plank floating just beneath the water's surface. Mortally injured, it bobs to the surface, kicking feebly. Some unfeeling human has fastened a small fish to a plank and has set it afloat, knowing that a hungry seabird would dive for the tasty morsel and break its neck on the unseen board.

A red-tailed hawk with a broken wing waits for it to heal at the Heaths' sanctuary in Florida.

Elsewhere, a blue heron wades the shallows of a shoreline, eyes alert for minnows. The bird tangles its long legs in a length of monofilament fishing line, which some fisherman has cut from the backlashed reel and tossed away. Unable to shake the line from its feet, the heron flies to its roost, there to pull and peck at the snarl. Inevitably, loops of the tough monofilament snag on a mangrove twig. The heron finds itself snared. A few hours of frantic flapping and flailing exhaust the bird. Soon, it hangs head down, helplessly awaiting a slow but certain death by starvation or dehydration.

Along the bay shore, power lines suspended from utility towers transmit electricity to homes and businesses in Tampa and St. Petersburg. At one point along the way, the lines pass near a rookery where young laughing gulls are learning to fly. The inexperienced birds, concentrating on their new skill, fail to see the wires strung across the sky. At 30 mph, first one and then another smacks into a cable with an audible twang. Some stagger, recover and fly on, unhurt. The less fortunate flutter to the ground below,

Native Texan Downs Matthews free-lances from Houston for several magazines.

Photographs by Dan Guravich

dead with a broken neck or doomed with a broken back or wing.

Increasingly, the works of man invade the realm of nature, with birds as frequent victims. Experts say they have no idea how many birds come to accidental grief each year by flying into, being hit by or becoming entangled in man-made objects. But Heath, whose activities are limited to the Tampa Bay area, treats an average of 20 a day at his beach-side bird hospital. Ninety percent, he reports, have injuries or ailments which are attributable to people.

While National Audubon Society experts report that the great preponderance of bird mortalities can be traced to the vagaries of weather or of food supply, or to natural predation, Heath's personal experience suggests that accident frequency rates are rising for birds. And for many injured birds, without a good Samaritan to furnish transportation to a place like Heath's sanctuary, death is inevitable.

"Birds don't carry hospital insurance," the 28-year-old zoologist wryly observes.

He displays a newly arrived patient, an egret, which a bird lover found flopping helplessly in her yard. "Broken wing," he explains. "Most common of all bird injuries. Herons and egrets seem to be particularly vulnerable to wing damage." He quickly splints and tapes the wing, and places the bird in an isolation cage for recuperation. Broken wings account for 32 percent of the injuries among birds brought to the sanctuary, he reports.

"Most of them fly into things they don't see. Glass windows. Guy wires. Power lines," he explains. "We lost 95 laughing gulls near here in two weeks last spring. They were mostly young birds which flew into electrical power lines." Many were killed outright. Others, unable to fly, starved. The power company, notified of the problem, decorated its lines with highly visible red Styrofoam cubes. Seeing these, birds veered away and avoided the lines.

But not all bird-injury problems are so easily or so cheaply resolved.

"About 23 per cent of our incoming birds are diseased," Heath says. Most of their ailments stem from feeding in water which has been polluted by human wastes. Inadequately treated sewage pouring into Tampa Bay sometimes infects birds, especially

Anesthetic is administered to a night heron before surgery to repair a broken wing is attempted.

A pin is inserted to support the heron's wing. The veterinarians contribute their services.

pelicans, with coliform bacteria. "About a year ago, 50 mature pelicans died, all apparently killed by fecal bacteria," Heath says. The disease produces severe toxemia which causes edema of the brain and, ultimately, death of the bird. "The edema seems to cause blindness," he says. "An affected bird will begin to fly, apparently unseeing, in a straight line until it runs into something."

St. Petersburg officials are moving to clean up the sewage problem. But, so far, authorities have been unable to do much about the problem of some of the fishermen in Tampa Bay; their sport results in more than 12 percent of the injuries suffered by Heath's patients. More than 85 percent of all the pelicans that come in injured are damaged directly by fishhooks and fishing lines.

Heath crumples a sheet of paper into a ball and tosses it to a pelican with a crippled wing and one eye. She catches it adroitly in her capacious beak and tosses it back. As their game continues, Heath explains that a fisherman snagged Pelican Pat with a hook, ripped out her eye, and smashed her wing. "Happens every day," he adds.

An outpatient, Pelican Pete, soars into the sanctuary yard to get his share of the 150 pounds of fish which the hospital's 350 feathered inmates eat each day. Pete makes an expert one-legged landing. "He got monofilament fishing line wrapped so tightly around one leg that its circulation was cut off," Heath recalls. "We had to amputate it to save him." For amputees, Heath fashions a prosthetic limb which he fastens to the bird's stump. It enables the bird to stand and move about normally until its strength returns. Then the artificial limb is removed so that the bird can learn to get around on one leg.

Linda Heath pushes an antibiotic capsule into a fish for a bird that will not swallow the pill by itself.

If you hook a bird . . .

"Fishhooks are rough on birds," Heath comments. "I've seen many dead pelicans hanging on trotline hooks." Sometimes, fish-eating birds try to steal a fisherman's bait, or strike at an artificial lure, and become painfully hooked. Rather than battle a hooked bird, some fishermen will cut their lines and let the bird go. Heath has treated pelicans with as many as eight fishhooks embedded in their flesh. But infection usually takes its toll, weakening the bird until it is too feeble to feed. If you ever do hook a pelican, Heath advises you to take it to a place such as his or to a veterinarian. Trying to pull out the hook yourself may do major, unnecessary damage.

No less pathetic are swimming birds such as cormorants or diving ducks which become entangled in discarded monofilament fishing line. It's a common occurrence, according to Heath, to find a bird carcass

The drug-bearing fish is then placed in a hole in an anhinga's throat. The wound eventually healed.

dangling from a mangrove branch at the end of a monofilament noose.

"They get things like nylon fishnet and plastic six-pack carriers stuck around their necks," Heath reports. Thus choked, a bird can't eat. If brought to the sanctuary, it usually has a dead fish in its throat which it is unable to swallow.

Ten percent of Heath's avian patients have internal injuries of some kind. Six percent have broken their legs. Seven percent suffer from starvation or malnutrition. Fractured necks, backs or skulls constitute three percent of injuries. Birth defects are seen occasionally. And, once in a while, a bird that has become fouled with oil is brought in.

Nature takes its toll, too, of course. Heath produces a picture of a mortally wounded cormorant, its back and abdomen ripped open in neat striations. "Shark attack," he explains. "Happens to about two percent of our seabirds."

What concerns Heath are the attacks on birds by people. Heath has statistics on the number of birds he has treated for gunshot, arrow and spear wounds. But he has no way of knowing how many of the broken bones and torn bodies he repairs are the work of cruelty freaks.

"There's some monster who catches birds, ties their beaks together, and then sets them free to starve," Heath reports. He recalls another who wraps cherry bombs in bread, lights the fuses, and tosses these loaded tidbits into the air for sea gulls to catch. The results are appalling.

Yet in Heath's mind nothing equals the inexplicable behavior of some speedboat operators whose pleasure is to run down seabirds resting on the water's surface. He has seen it happen, but has never been able to catch one of the perpetrators. "It's usually some slob in one of those expensive inboard speedsters that'll do 65 miles an hour. They roar around the bay, swerving again and again to hit and kill any birds they see floating on the water."

Heath is at his best saving birds which his fellow citizens have damaged. About 42 percent die: "They're too far gone to save when I get them." But the remaining 58 percent live. Of these, most are able to return to their natural habitat after an average stay of about a month. Some take several months to recover, and at least one bird stayed at the sanctuary a full year before leaving.

Some, too handicapped by injury to make it on their own, become permanent guests of the sanctuary. Heath cares for about 275 flightless birds which will never be able to leave.

Heath has donated his own time since he opened the sanctuary in 1971. He gets medical help from veterinarian Dr. Harold Albers. Linda cares for the land birds and birds of prey, and raises all the baby birds brought to the sanctuary. Teen-agers volunteer their assistance. Money for food and medical supplies trickles in from friends, the public and a number of local organizations.

The bird population of Pinellas County is declining as its human population increases. Heath can do little about habitat destruction, but he can alleviate some of the direct effects. His bird hospital, he feels, helps to soften the impact of people on birds.

A lure and line hang from this pelican's beak. One bird was found with eight hooks embedded in it.

This fishing lure shackled a pelican's feet together and it died, no longer able to swim.

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SYNERGISM. Ben Rose.

Photographs by Jerry Cooke
Text by William O. Johnson

For the Chinese woman and child: a new life-style

Madame Mao surprises her countrymen by wearing Western dress as a special courtesy toward Americans at an international basketball game.

In the new China, wife-beating and polygamy are out; a kind of drudgery is in; and the young get care, freeing their mothers

Summer in China is hot and tranquil. Mostly, people work—seriously, steadily, tediously. City streets are glutted with brigades of silent bicycles hauling produce, machine parts, bundles of bricks, bales of cloth. Drably dressed pedestrians hurry along beneath giant billboards which exhort them to work harder, live cleaner, believe more devoutly in revolution.

In the countryside, highways are lined with marching school boys and girls, bound for communes and farms to help with planting or the early harvest. Rural roads teem with loads of straw, jugs of fertilizer, baskets of grain hauled on bikes, trucks and cattle-drawn carts, but more often on men's and women's backs.

Behind the summer scenes of toil and the torrent of revolutionary rhetoric there is a gentler, subtler China to measure. It exists in the laughter of schoolchildren, in the stealthy ecstatic step of a little boy who has just caught a forbidden fish, in the serenity of a woman at rest under a willow tree, in the pleased smile of a peasant mother who has gathered broods of both children and chickens around her.

There may well be more of the inspiration of today's China—and of tomorrow's—in the wondering gaze of one tiny girl wearing her best floppy summer hat than in all the billboards and production figures in the land. And, just possibly, what cannot be seen in the eyes of that tot may appear in the dignified, even *regal* figure of Chiang Ch'ing (above), wife of Chairman Mao and, for years now, one of the half-dozen toughest and most influential policy-makers in the politburo of the People's Republic. These two ladies —beautiful child and powerful woman—are a personification of Mao's extraordinary quarter-century, for there is nothing quite so perfectly symbolic of the true depth of revolution in China as the abrupt change it has brought to the lives of women.

In Hangchow, a small citizen of a very large nation peers at the intriguing mystery of a tall foreigner armed with a little camera.

China's women have been yanked free from a wretched plight that infected some 40 centuries of Chinese culture. With a single stroke—the Marriage Law of 1950—women were given full legal equality with men, including the right to divorce and to own property. Wife-beating was outlawed, along with female infanticide and arranged marriages. To understand such change, we have to look at "the bitter past."

One proverb summarizes it all: "A wife married is like a pony bought; I'll ride her and whip her as I like." For centuries, female babies were frequently killed, women were sold as slaves by their poverty-stricken families, teen-aged girls were dealt out for large dowries to become the wives of infant boys, then used as field hands or scullery maids by their in-laws

Kindergarten children in Peking perform a dance.
They are assiduously supervised while Mother works.

Tiny girls join in a lively song. At what is now
their school, silkworms were once raised.

until their baby "husbands" grew old enough to sire sons of their own. Suicides among anguished brides-to-be were common. The death in 1919 of one Miss Chao Wu-chieh, who cut her own throat with a dagger just as she was being lifted aloft in her bridal chair to be carried to her wedding with a man she detested, became the central subject of a series of angry essays on women's liberation by the young Mao Tse-tung.

One horrible symbol of women's "bitter past" was the practice of binding their feet. Not only were crushed, tiny feet considered beautiful and sexually stimulating, they also marked a husband's prestige in his community: Only a man of means could afford to have a wife who couldn't walk. Foot binding was quite literally a form of torture. When a little girl reached just about the age of our wondering child in her floppy hat (p. 38), her toes were forcibly curled down under the sole of her feet and tightly bound with strips of cloth. Her arch was forced into a clenched curl, too, and bound with strips wrapped round from heel to front. As the the child grew, her foot could not expand within the viselike grip of the bindings; the bones of her toes and arch would slowly crack, and finally fracture completely.

Then the bones would eventually reset themselves in the clubbed position so prized by men. The practice continued into the 1930s, so there are still many old women in China today who can scarcely hobble about.

A saying now current in China has it that "Women

Superimposing U.S. area map shows China's size and the dispersion of the cities Johnson and Cooke visited for *Sports Illustrated*. They found far more than sports to report.

This small boy, bursting with surreptitious joy, has caught a fish—illegally—at West Lake, Hangchow.

hold up half the sky." Driving through the country reveals them working at everything from heavy construction to farm chores. In conversation the philosophy of sexual equality is consistently repeated. Yet the facts fall short of perfection. Women hold no more than one-third of the jobs in heavy industries such as shipbuilding or petroleum manufacture, and those jobs include the staffing of canteens, clinics and child-care centers. In the traditionally women-oriented industries—embroidery or brocade factories—they have up to 90 percent of the jobs. In rural communes and factories, workers are paid wages on the basis of a point system which, in turn, is weighted toward work accomplished through physical strength.

Women still do nearly all of the housework (for which they receive no pay). They hold almost no top positions in the national government, in the military, in industrial management. Yet it seems that in some ways Chinese women may be closer to liberation than American, if only because the crusade for equality is an essential part of the fixed ideology of the state. As our trip proceeded through China—Peking, Hangchow, Shanghai, Canton and the countryside around them—we never could, through observation, reach a definitive conclusion about the true place of women. On the other hand, we could not help accumulating a patchwork of vignettes which may be more interesting (if less absolute) than a harder line of reporting.

The first truly alien aspect of China which every Western visitor comments on is the dreary sameness of the people's appearance. The streets seem like steady gray rivers, devoid of color. What is missing is the bright stream of fabrics and design that Western women wear. Though it is perhaps chauvinistically male to mention it, the lack of obvious female sexual images in Chinese crowds is profoundly disconcerting at first and leads to a striking sense of cultural dis-

Hangchow girl straightens her boyfriend's collar in a rare display of affection.

Girl workers pick tea at a plantation outside Hangchow. They earn same wages as male pickers.

placement. There is no semblance of bosom, ankle or derrière in the baggy dress of the Chinese, no flowing hair (all wear bobs or pigtails), no cosmetic enhancement of natural beauty. One Western man studied the women of Canton for a time, then exploded, "It's downright *unnatural!*"

In fact, of course, the opposite is true. As Linda Gordon, a University of Massachusetts historian, observed after her visit to China: "Young Chinese women walk differently from women in the West, with larger more swinging steps. Their jaunty, confident stride is the walk of women who are not self-conscious. This is in striking contrast to the manner of Western women who have learned to walk down streets constantly aware of their bodies being appraised." In short: There are no wolf whistles in China.

Rare moments of public affection

There is also almost no public show of warmth or affection between the sexes. Even on darkened streets where couples walk together, they don't hold hands. Twice only I have observed moments of affection, both at lovely, romantic West Lake in Hangchow. Once a girl reached up tenderly to straighten the collar and caress the neck of her boyfriend, who had just completed a wildly energetic display of *wushu,* the ancient calisthenic art of practicing self-defense. When she realized she had been observed, she flushed and refused to speak. Another evening, at sunset, a couple sat on a bench by the lake, not kissing or even holding hands, but leaning close together, occasionally touching their cheeks. The young lady suddenly realized they were being watched and quickly opened an umbrella as a shield. A moment later she peeked out, coquettish as any French maid in a drawing-room farce.

Farm family near Canton lives well on its own produce, raised along with communal food.

At a commune outside Shanghai where hollyhocks grew everywhere among the peasants' homes, an elderly woman with snow-white hair showed off part of her family's living quarters. There were two rooms, and the one she displayed had a dark brown wooden chest with a small white bust of Chairman Mao upon it, an old alarm clock and a brown plastic radio. On the wall there was a colored photograph of a performance of the Peking Opera. The woman spoke in a ringing voice through the interpreter: "Ten people live here: my husband and I, my son and daughter-in-law and their six children. We have a plot for growing our own potatoes, onions, beans, corn. It is 30-by-50 feet. We eat our own produce mostly and the food grown by the commune is sent to the city. Each family in the commune averaged 700 yuan [$364] income last year. We have electricity here. This is a typical farmer's house." She curtsied like a small girl.

In Tao Chao commune far down in the rich delta of

Tea plantation worker has "the natural look,"
born of a lifelong sense of self-confidence.

the Pearl River below Canton, two Americans were entertained by leaders of the commune's revolutionary committee. A fine fresh farmer's lunch was served —roast chicken, pork livers, carp cooked in succulent green sauce, vegetables freshly picked just before they were steamed. The committee chairman was asked if it was uncommon for people from rural China to marry someone from a city such as Canton. "They may seek their beloveds anywhere they wish," said the chairman. A waitress said something with a smile which was translated: "A city man would not understand fertilizer on the land and probably would not make as good a beloved as a man from the country."

Children board at kindergarten

The Pei Hai kindergarten of Peking is in a flower-filled park enclosed by a brick wall covered with vines. A century ago, this was the silkworm garden of the Ch'ing dynasty. The headmistress of the school is kindly and bespectacled and speaks very good English. She explains that the children all live at the school from Monday through Friday so their parents can work. There are 300 children, aged three to seven, and for every 30 of them two teachers and a nurse are assigned. "We must be with them constantly, for they are very small, you see. And at night we must be there if they call, to help them pass water or to straighten their quilts, and so on. The teachers are all very dedicated to the Great Proletarian Cultural Revolution and they are now, more than ever before, concerned with implementing Chairman Mao's plan for educating children so that they develop to their fullest, morally, intellectually and physically, and, in later life, produce many successes for the cause."

The headmistress smiles gently, speaking at all times in a mild and lovely voice. She rises to lead a tour of the kindergarten. Though there is a lot of sunshine in the rooms, they have almost none of the assortment of toys and educational materials found in American kindergartens. The headmistress says that the children are expected to read and write 15 Chinese characters, count to 100 and add and subtract the numbers one through 20 by the time they leave kindergarten. "They are also taught to sing many songs, to play games to music and to do simple dances. In art, they fold papers to preassigned designs and make clay models. The three-year-olds are taught to dress themselves.

"All children are taught how to properly set a table with chopsticks and bowls and they are taught to love the great leader Chairman Mao, communism and the motherland. They are taught internationalism—that the people of all the world are our friends. When the Chinese Ping-Pong team visited America, the children were told that they had been welcomed warmly by the

Engrossed and unselfconscious, a Hangchow girl reads in the tree-shaded city park.

American people. The children were very pleased."

She moves like a gentle moth through the classrooms and then supervises a program by the children. Many of them are in costume and the show—almost of professional caliber—lasts nearly an hour. The children sing a song which is translated as "a song of praise for those on the people's communes who raise pigs." Another is titled "I'm a Small Duck with a Flat Mouth and a Small Tail with White Feathers." One group of children, dressed as cooks, dance and sing: *The bread I make is both big and round, the meals I serve are delicious and everyone praises them. I will bear in mind the Chairman's teachings and be a servant of the people when I grow up.*

In the playground dozens of tots are giggling and tumbling about, obeying Chairman Mao's request for physical fitness to further the revolution. The kindergartners all wear bright-colored clothing in contrast to the usual dreary adult dress. The headmistress explains, "They are dressed in colors *because* they are children and we love to see them look bright and happy. Isn't the same true in America?"

Hangchow's park still offers an exquisite haven for leisure . . .

. . . and the Chinese
still visit their Great Wall–
a link with history

(If you want a pizza in Hong Kong, you might try La Bella Donna at 51 Gloucester Rd., Wanchai.)

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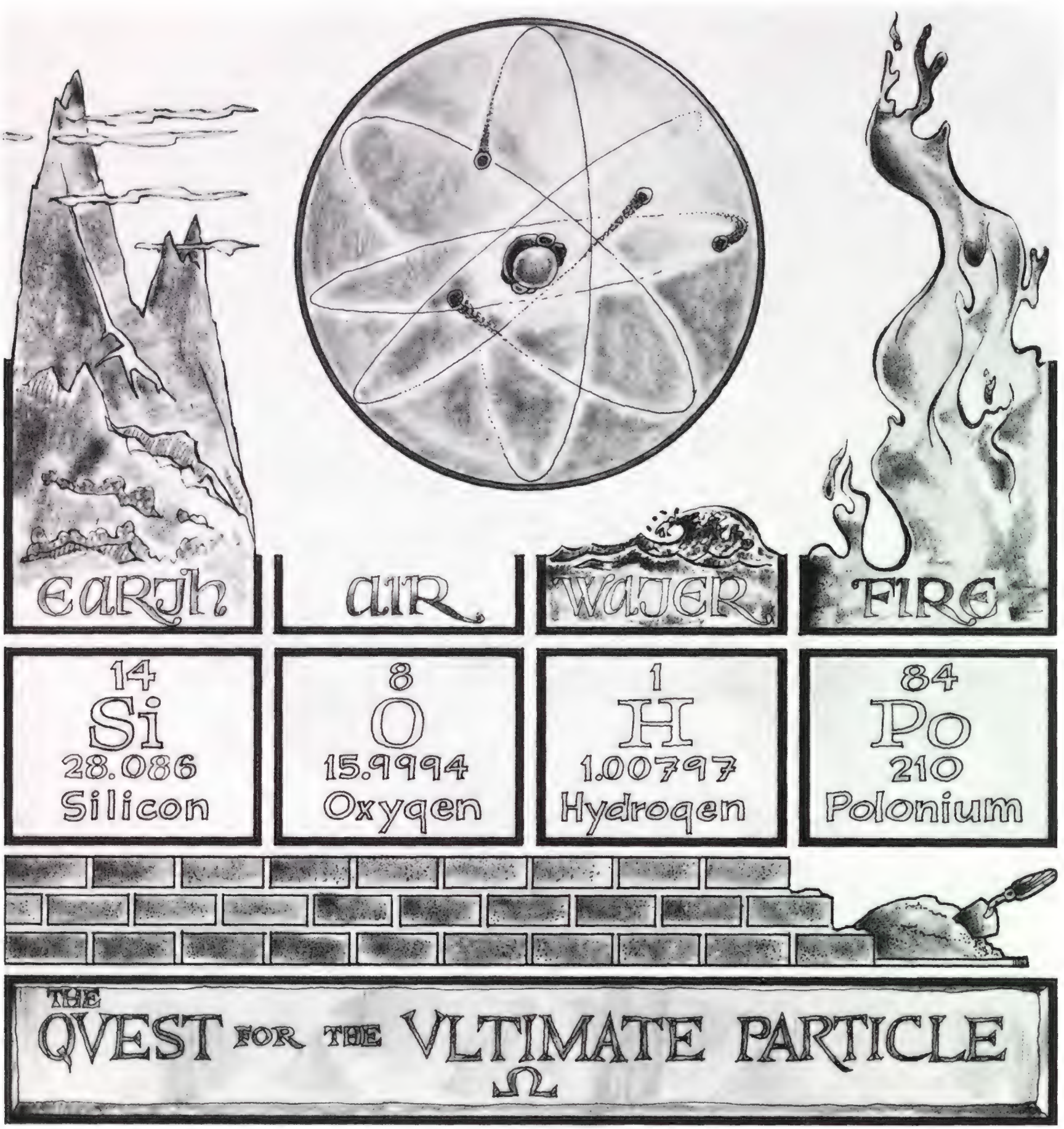
Physicists try to peel off the latest, but not the last, layer of matter



Since the Greeks discussed earth, air, water and fire as the basic constituents of matter (see Isaac Asimov's four articles in 1971), we have progressed to chemical elements and atoms, but are still far from understanding the ultimate nature of matter. We may be discovering that we will never really know.

With hundreds of 'elementary' particles known, the stage seems set for still another discovery of basic building blocks

By James S. Trefil

Illustrations by Jan Adkins

Russian children are often given a fascinating toy. It is a large wooden doll, usually in the form of a woman. At first glance, it looks perfect and complete—a simple toy. When one examines the doll more closely, however, one finds a slight flaw—a small crack around the center. One's first impulse is to ignore this slight flaw, but if one examines the crack closely, pulls at it a bit, the doll comes apart. What had looked like a doll was only a container. Inside the doll is another, smaller doll. This, too, looks perfect at first glance, but shows, under close examination, a small crack at the middle. The process is repeated over and over until one has a whole series of smaller and smaller dolls.

The Russian doll is like our understanding of the world around us. At any given time, people have ideas about the world and how it operates. At the same time there are inevitably a few facts—little flaws—that don't quite fit in with these ideas. And every once in a while, someone comes along and shows how these flaws play the same role as the crack in the doll's waist and lead us to a deeper understanding.

In the world of physics, thought of as the study of matter and its interactions, we have gone through several sizes of doll in this century. We may be on the verge of uncovering the last doll—or of discovering that there is no last doll.

Like most of our intellectual traditions, the beginnings of the quest for the ultimate nature of matter can be traced to the Greeks. In the fifth century B.C., philosophers in Ionia (now western Turkey) debated whether matter was composed of earth, fire, air or water, or of some combinations of these "elements." The idea that the bewildering complexity of things that we see in the world could be made up of a few simple substances, much as a complicated building can be made from simple bricks, is a leitmotiv in the history of science.

It was the Greek philosophers Leucippus and Democritus who gave us the idea of the atom. To understand how the Greeks first came up with it, we have to realize that one of the great debates which swept Greek philosophy was over the question of change. Some philosophers held that everything in the world was change and flux, and that nothing was enduring or permanent.

At the same time, the problem of *how* changes could occur in the world was extremely puzzling to the Greek mind. Zeno of Elea devised the famous paradox which bears his name, which "proves" that it is impossible to cross a room, because to get to the other side it is necessary first to go halfway, then go half of the remaining distance, and so on. Since there is an infinite number of remaining halves to be crossed, we can never get where we are going and movement must be impossible. If you were thinking in this way, it would be hard to understand what happened when changes took place in physical substances. How could water, for example, change from liquid to a solid when it was frozen, and to a gas when heated?

The "atomists" produced a neat answer to the dilemma of change. They reasoned that if we began slicing a piece of material into smaller and smaller pieces, sooner or later we would have to come to a point where we could divide it no longer. These smallest pieces of matter they called "atoms" (*atomos* in the Greek, meaning that which cannot be split). They suggested that these atoms were unchanging and eternal, but that the *relation* between atoms could change and produce the kind of processes that were seen in the world. Thus, the atomists would explain freezing as a change in the relation between water atoms, but with no change in the atoms themselves.

This picture of the world seems to have something for everyone. Nonetheless, atomism as a philosophical idea remained a curiosity—almost a skeleton in the closet of Greek philosophy—throughout the Middle Ages. It was revived by the early 19th-century chemists on a much different footing.

By the end of the 18th century, a large amount of knowledge about the chemical properties of matter had been accumulated. In particular, it was known that there were two basic types of chemical materials: those that could be broken down into other materials, and those that could not be. The latter were called "elements," and were thought to be few.

While a bewildering number of chemical substances other than elements could be manufactured in the laboratory, inexplicable regularities were discovered in the way these substances could be broken down into elements. For example, when water from any source was broken down to the elements hydrogen and oxygen, there was always about 12 percent hydrogen and 88 percent oxygen by weight. Many other regularities

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Zeno of Elea and John Dalton considered how water can be a solid and a gas and whether the atoms of which it is composed might look like billiard balls.

like this were discovered, and were grouped under the name "Law of Definite Proportions."

It was the English chemist and physicist John Dalton who realized that the "law" could be explained by a revival of the old idea of atoms. He saw that such regularities could be explained if each element were composed of indivisible, characteristic lumps of matter. He actually thought of these "atoms" as little round billiard balls, as drawings in his texts show. The process of chemical combination took place when these atoms were stuck together, and a substance was broken down when they came apart. For example, water was made up of one oxygen and two hydrogen atoms (oxygen atoms are much heavier than hydrogen atoms). In addition to explaining the existence of so many chemical compounds, this picture also explained the Law of Definite Proportions, since the proportion of a given element in a chemical substance depended only on the weight and number of the individual atoms making up one molecule of it.

Two features of this revival of the atomic theory in modern times should be emphasized. First, unlike the Greeks, who arrived at atomism as a compromise between different philosophical systems, Dalton introduced his hypothesis to explain experimental data. Second, the picture of the world developed by Dalton was a very simple one. The basic building blocks of matter were the little "billiard ball" atoms, and all of the many chemical substances known at the time were merely different structural combinations of these simple building blocks. This feature of Dalton's view is still very much a part of our modern ideas.

Unfortunately, this beautifully simple picture of the world was not destined to remain that way very long. The accelerating pace of scientific activity in the 19th century quickly uncovered new facts that were difficult to explain in terms of the simple atomic model. For one thing, the number of known chemical elements grew rapidly to 82 by the end of the century. (Today we know of more than 100 and dozens more will probably be manufactured artificially within the next few years.) Thus, instead of relatively few "basic building blocks," it was found that there are a good many.

At the same time, new and inexplicable regularities in the behavior of chemical elements were being discovered. These were put into a systematic form by the Russian chemist Dmitri I. Mendeléev when he arranged the known elements into the periodic table. In this systematic array, elements in the same column in the table would have the same chemical properties. Thus, fluorine and chlorine are caustic substances, rather dangerous to handle, while neon and argon do not undergo chemical reactions at all. This grouping marked a giant step in the practical uses of chemistry, but at the time it was discovered no one could say why it should work, just as before Dalton no one could explain the Law of Definite Proportions.

With these developments, scientists who were investigating the structure of matter at the beginning of this century were in pretty much the same boat as they had been at the beginning of the last. There were a large number of things which could qualify as basic particles, and unexplained regularities in their behavior. Then, in 1911, a remarkable experiment was carried out in Manchester, England, which showed for the first time that the atoms, far from being simple, nondivisible blobs of matter, had a complicated structure of their own.

It had been known for a long time that some substances give off mysterious radiations. The emissions from these "radioactive" substances were classified as alpha, beta and gamma rays. We now know the alpha rays to be two protons and two neutrons (they are identical with the nucleus of a helium atom), the beta rays to be electrons, and the gamma rays to be energetic X rays. Although it was known that these rays could penetrate matter, Ernest Rutherford, who had already received the Nobel prize in 1908 for his work on radioactive substances, suggested to his colleague at Manchester, Johannes Geiger (the inventor of the Geiger counter) that it might be interesting to see what actually happened to the alpha particles which did not go straight through a piece of material.

The project was not considered to be all that important—a simple matter of cleaning up a few details—and it was assigned to a student, John Marsden. An experiment was set up in which a beam of alpha particles coming out of a naturally radioactive source was directed toward a thin gold foil. It was found (as expected) that most of the alpha particles passed through the foil, but that a few (about one in a thousand) were bent through large angles, up to even 180 degrees, by collisions with the gold atoms.

This result was totally unexpected. If the atom was really a featureless blob of matter, or if, in the ideas held by most scientists at the time, it was a blob of matter in which electrons were imbedded like raisins in a bun, then shooting an alpha particle through the atom should have been like shooting a bullet through a cloud of smoke. There was nothing in that kind of atom which should have been able to turn the particle around (the electrons are far too light).

Instead, the fact that some particles *were* turned around could only mean that somewhere inside the atom was a small, hard object. It would be as if there were a bowling ball in the cloud of smoke. Most of the bullets would miss the bowling ball, and go right through the cloud. But once in a while, one would hit the ball and ricochet (see illustration below).

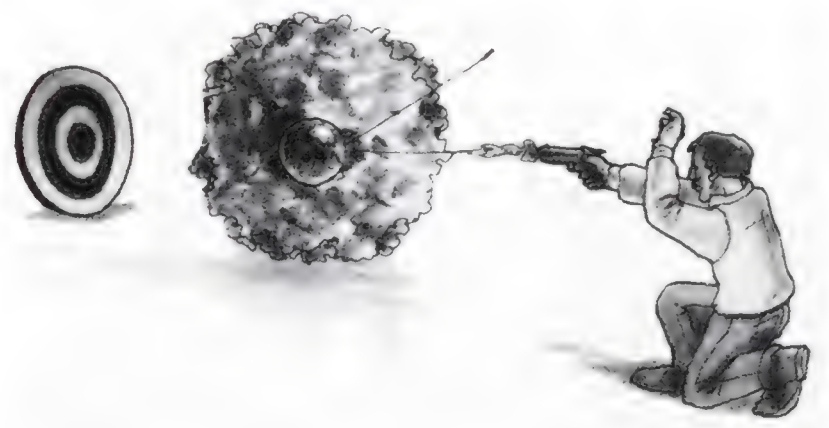
Rutherford realized that this must have been what was happening, and proposed a model for the atom which is very familiar to us today. At the center was a small nucleus, made up of two kinds of heavy particles: a positively charged particle called the proton, and a heavy particle with no charge called the neutron (the proton was known at this time, but the neutron would not be discovered for another decade). Surrounding this nucleus was a swarm of tiny, negatively charged particles called electrons (these particles had been discovered by 1900, and were known to be the particle which carried ordinary electrical current).

With the discovery of the nucleus, it seems as if we have returned to a version of the ideas of the atomists. The three basic building blocks of matter are the proton and neutron, from which any atomic nucleus can be constructed, and the electron, which, when added to the nucleus, makes up the atom. The atoms formed in this way, then, can be combined into chemical compounds in the way that Dalton had discussed a century earlier.

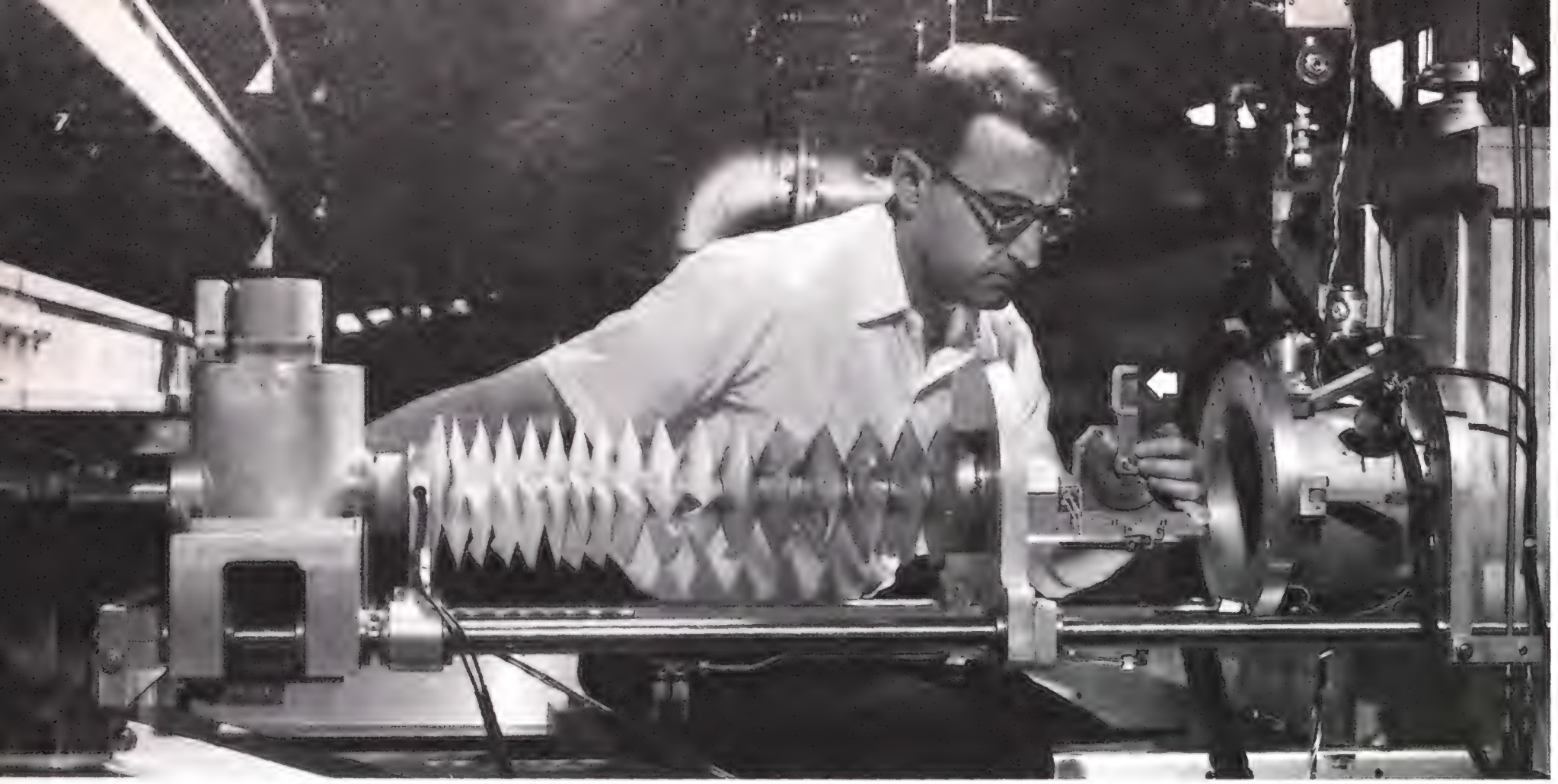
This idyllic state of affairs, in which we believed that we had reached an understanding of the universe in terms of a few simple particles, lasted until the late 1940s. At that time, some new experiments were carried out in Bristol, England, with results that were to make life complicated again and open whole new fields of physics.

We know that the Earth is being constantly bombarded by particles from space, called cosmic rays. Some of these particles (which are mostly protons) come from the sun, others come from stars in our own galaxy, and a few may even be visitors from other galaxies. Cosmic rays were usually studied in devices called cloud chambers, which are so constructed that a visible track of minute droplets appears along the paths of a charged particle. These drops form around

When British scientists fired particles at atoms early in the 20th century, they expected them to go right through like bullets penetrating a bun.



Instead, some of the particles bounced back, showing that within the atom there was a hard object, the nucleus. Today we find such structure in protons.



A copper target (arrow) is prepared to be placed in the beam of the accelerator at Brookhaven National Laboratory on Long Island. Detectors will identify particles produced in the collisions.

atoms with which the particle has collided, and pictures can be taken of them.

The most common type of events were "stars," in which the cosmic ray collided with a nucleus and produced a spray of protons (although neutrons were also produced, they leave no track since they have no charge). But a few events were found where, far away from a star, two particles suddenly appeared, apparently from nowhere, to form a V (see p. 56).

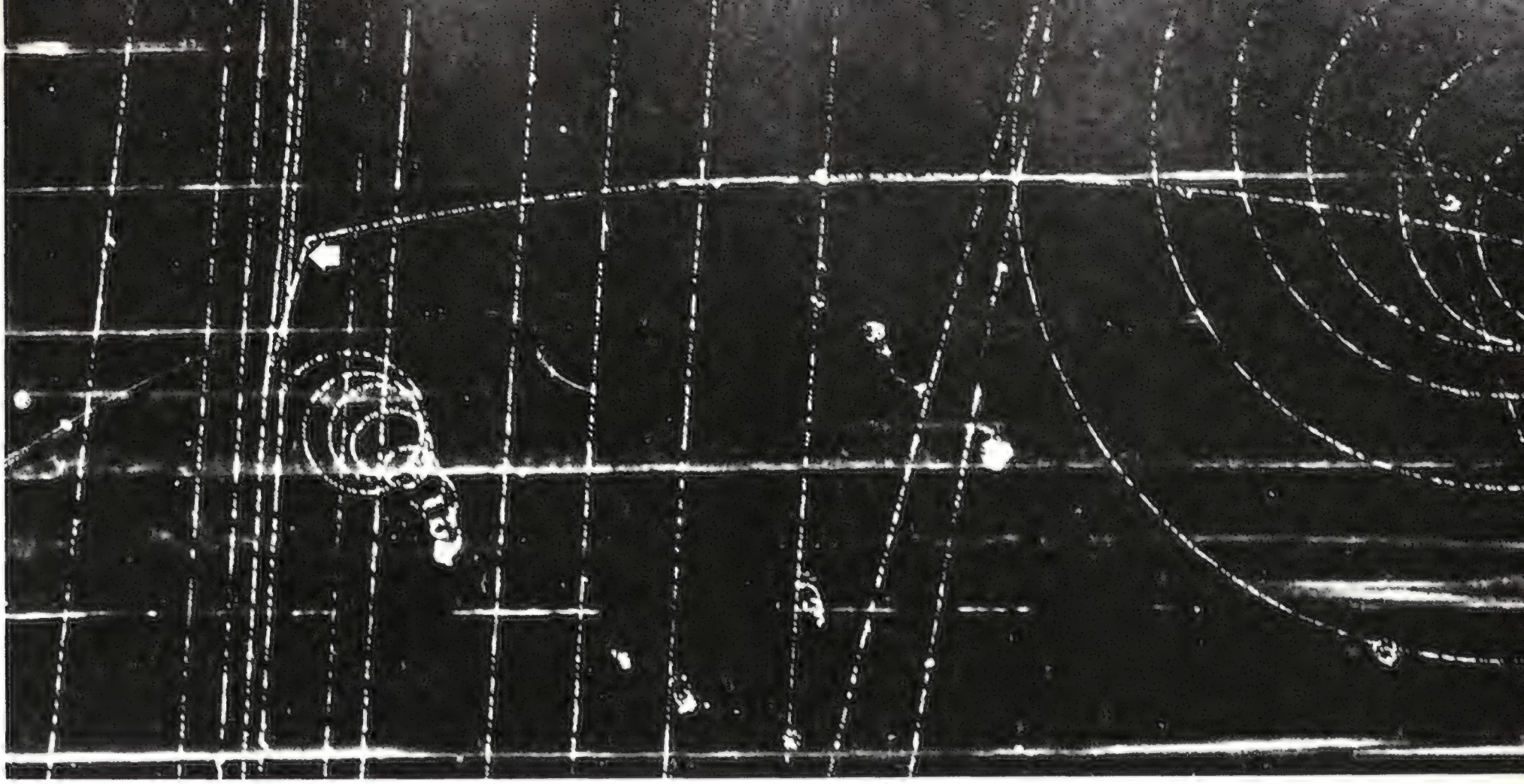
These "V" events could only be explained by assuming that neutral particles, leaving no track, had gone from the nuclear collisions to the points at which the V appeared, and then changed into two charged particles (which did leave tracks). They couldn't be protons or electrons, since they leave tracks in a cloud chamber. They couldn't be neutrons, because it turned out that the V particles had to weigh less than the proton and neutron, but more than an electron.

The V particles, then, were a new kind of particle, and even though they lived for a very short time (as long as it took to get from the star to the V), they were clearly "elementary" in the same sense that protons and neutrons are. These original V particles were the first of a whole new class of particles called "mesons," so named because they are intermediate in weight between the electrons and the proton. We now call them K mesons. Discovery of other mesons, the mu and the pi, followed quickly.

The existence of "mesons" had been predicted by Hideki Yukawa, a Japanese physicist. If we think of the proton and neutron as the building blocks of the nucleus, then the mesons are thought to play the role of the mortar, and serve as the means whereby the nucleus is held together. Our modern picture of the nucleus is one in which the protons and neutrons sit more or less sedately in a "sea" of mesons, which are forever zipping around them. Since the positively charged protons left to themselves would fly away from each other (because like charges repel), the very existence of the nucleus depends on the mesons exerting enough force on the protons and neutrons to keep it in one piece.

The scenario may now be familiar to the reader. First, a simple system with a few basic building blocks is developed. Then it is discovered that there are more kinds of blocks than one had thought. In fact, following these discoveries in cosmic rays, large accelerators were built in this country and in Europe to accelerate protons up to billions of volts of energy, and smash them into targets. When this was done, literally hundreds of "elementary" particles like the mesons were discovered in the debris of the high energy interaction. An entire new field of physics opened up, called "high energy" or "elementary particle" physics.

A convenient classification scheme for the particles is provided if we define leptons as particles like the



In this photograph, a particle predicted by symmetry theory was discovered for the first time. The lines running from bottom to top are K mesons fired into a tank of liquid hydrogen. One hit a hydrogen nucleus and produced a spray of particles, including the omega minus (arrow) and others that left no tracks. The omega minus quickly decayed into other particles, including a pi meson (the horizontal track).

electron which do not serve the purpose of holding the nucleus together, and hadrons (from the Greek for strong) for those that do. A further subdivision of hadrons is usually made into mesons (particles of intermediate weight) and baryons (heavy particles). Baryons are those particles which, when they decay into other kinds of particles (as did the particle that produced the V in the cloud chamber), eventually leave a proton or neutron, while mesons do not.

There are other distinctions between particles which can be made as well. For example, some hadrons decay in 10^{-24} seconds—the time it takes light to cross a proton (10^{-24} is shorthand for 1 over 1 and 24 0's —or 1/1,000,000,000,000,000,000,000,000). Some decay more slowly—in perhaps 10^{-15} seconds. These latter decay very slowly on the time scale of elementary particles and are given the name "strange" particles. Strange baryons are sometimes called hyperons.

If you are confused by this plethora of definitions, you are not alone. By the early 1960s it was becoming increasingly clear that the idea that everything could be built from protons, neutrons and electrons was a fast-disappearing dream. The "elementary" particles were proliferating at a rapid rate, just as the chemical elements had in the last century.

If we believe that history repeats itself, the next thing we would expect would be the discovery of something like the periodic table for elementary particles. In fact, just such a scheme was discovered in the early 1960s, and goes under the general title of "unitary symmetry," or "the eightfold way." It was suggested by Cal Tech physicists Murray Gell-Mann (who received the Nobel prize in 1969) and George Zweig, and independently by Israeli physicist Yu'vaal Ne'mann, that if the elementary particles were grouped in certain rows and columns, then particles in the same row should have similar properties.

This way of grouping the elementary particles is in many ways analogous to the periodic table of the elements. For example, in the group of eight particles that is the prototype for the eightfold way, the top row contains the proton and neutron. Even though these particles appear to be different (the most obvious difference being the fact that they have different electrical charges), they interact with other hadrons in much the same way, just as hydrogen and lithium, which are both in the first column of the periodic table, have similar chemical properties, even though one is a gas and the other a metal.

A second important analogy has to do with the prediction of new elements. One of the great successes of the periodic table of the elements was that when it was put together there were a few gaps—places where elements should have gone, but where no elements were known. Taking a cue from this, chemists undertook a search for these "missing" elements and

soon found them. (They are known today as gallium, scandium and germanium, the latter being of great importance in transistor technology.)

In an exactly analogous way, when the unitary symmetry groupings were put together, there were gaps, the most obvious being a missing particle known as the omega minus. An intensive search for this particle was undertaken at Brookhaven National Laboratory, where it was discovered in late 1964 (see p. 55). This marked a great triumph for the "periodic table of elementary particles." It is now believed that most of the particles we know can be fitted into such tables.

But why? It was quickly realized that one way to explain both the abundance of "elementary" particles and the observed regularities between them would be to assume that these particles were not "elementary" at all. Just as the atom had turned out to be made up of sub-units called protons, neutrons and electrons, the protons, neutrons and the other elementary particles could be thought of as being composed of sub-units. The sub-units which would give the right "periodic table" of the elementary particles were named "quarks" by Gell-Mann (after a line from *Finnegans Wake*—"Three quarks for Muster Mark"). The idea was that there were three quarks (called the proton quark, the neutron quark and the lambda quark) which would provide the basic building blocks of matter. From the quarks, we then build the elementary particles, from the particles we build the nuclei, from the nuclei we build the atoms, and from the atoms we build everything we see around us.

We have certainly come quite a way from Democritus.

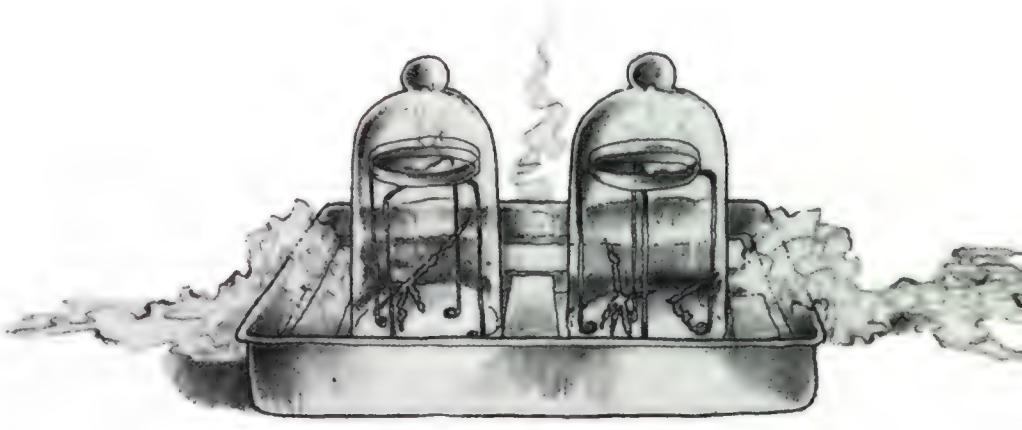
Once the idea that protons and neutrons might themselves be made of something else, experiments were designed to see if the idea really worked. At the Stanford Linear Accelerator Center in California, a machine was built to accelerate electrons to 20 billion volts. In an experiment like Rutherford's, these very fast "bullets" were fired at a proton target. Against all expectations, it was found that there were many more electrons scattered through large angles than would have been expected if the proton were just a smooth, featureless blob of matter. One interpretation of this result, which bears such a striking resemblance to the Rutherford experiment which preceded it by 50 years, is that the electrons are "seeing" the constituent particles inside the proton, just as Rutherford's alpha particles "saw" the nucleus of the gold atom.

The stage would seem to be set, then, for another fundamental revision of our answer to the question "What is matter?" Many searches for the quarks have been made. They actually would be pretty easy to identify if they were found, since they are supposed to have electrical charges which are one-third and two-thirds of the charge of the electron. At this writing, however, none of these searches has come up with convincing evidence that quarks are to be found in nature. It is as if Rutherford had discovered the nucleus, but no one had been able to find a proton or neutron despite long, intensive effort.

So that is where things stand right now. All the evidence points to the fact that what we have been calling elementary particles are not elementary at all, but are built from other, still more elementary, particles. Yet these sub-particles remain elusive, and are not seen in even the most cleverly designed experiments.

What to do? Physicists have made many proposals: quarks that have the same charge as the proton and electron, but have other unusual properties, and quarks that exist deep inside the proton, but which come apart as they are pulled out, like a sand castle when it's moved. Whether any of these ideas will prove correct remains to be seen.

Meanwhile the experimental studies of the properties of the elementary particles, and the searches for quarks and other new kinds of particles, are being



Most cosmic rays produce a spray of particles in a cloud chamber, as has happened at left. But some produce a V of particles some distance away, as at right, which led to the discovery of mesons.

pushed forward at facilities like the mammoth National Accelerator Laboratory at Batavia, Illinois (See SMITHSONIAN, December 1971). This machine, which can accelerate protons up to an energy of 500 billion electron volts, is the world's largest accelerator, and has become a major center for the study of elementary particles since it began operations several years ago.

But when we start to think about the possibility of discovering quarks, or some other species of sub-elementary particles, a nagging doubt occurs. Even if we find it, how can we be sure that it is really "ultimate," and that a hundred years from now someone won't be looking for the sub-quark (or the sub-sub-quarks—the possibilities are endless).

Well, we can't be sure at all. If nature has chosen to build matter like an onion, with layer upon layer, then the ultimate atom that Democritus wrote about will be forever beyond our reach. It is certainly true that with foreseeable technological advances in accelerator design, it is doubtful that the ability (or the money) will be available for a search for anything beyond the quark.

But before we throw up our hands in despair, let us remember that the task of the physicist is *not* to find an ultimate particle, but to discover the real nature of matter. Either the discovery of the quark or a proof of the "onionlike" properties of matter is germane to this objective.

And consider this: If all of the scientists since Dalton have just been peeling layers off of the onion, and if you think for a moment of the tremendous advances in the standard of living which have accompanied knowledge of each new layer, you will realize that there are likely to be tremendous practical benefits from peeling off the next layer. If the history of technology has taught us anything, it is that when new basic knowledge is introduced, it becomes a useless sort of thing. Even electricity was considered to be an amusing diversion by early "electricians." But sooner or later, a bright engineer comes along and finds ways of turning the knowledge into useful ways of bettering the human condition.

The situation is something like that in elementary particle physics. Most people working in the field (myself included) would undoubtedly say that talking about anything useful coming from our work was pure "moonshine." And if we prove to be as wrong as Rutherford, we will at least be in good company.

The drawers in this hypothetical shop are pretty well filled, although some changes in labeling may be necessary in the future. But hypothetical containers of quarks are basically empty despite our best efforts.

By Rudolph Chelminski

Surviving spas of Europe evoke past gilded age

The wealthy still flock to traditional resorts to take the waters, but no longer do they also bathe in extravagant social whirlpools

"Mother went to Carlsbad every year for the cure. It took a month, was recommended by her doctor, and she took it very seriously. She thought it was what kept her in good health for the remaining 11 months."

I have stolen this reminiscence from a letter by an American lady of my acquaintance, because it says so much about Europe. The spas! What a prodigious institution, and how little we know of them here. In their glorious days they were a cultural, social and physical imperative deeply ingrained into upper-class European habits. The seasonal journeys, mostly in August, were a fundamental migration as natural as removing to the salon for brandy after dinner. Year after year the rituals repeated themselves in the evocatively named garden towns: Baden-Baden, Marienbad, Carlsbad, Montecatini, Aix-les-Bains, Vichy and, of course, Spa itself, the little Belgian village (pp.64-65) which lent its name to the English language as the generic term for all watering places.

Taking the waters was regarded not only as a way of insuring good health, but a necessary *dépaysement* as well, an escape from the sterility of city life and its

Clients belly up to the "bars" at Augustabad, a modern spa built in 1966 above Baden-Baden, to toss down glasses of sulfurous water. Mud packs and chiropody are also available.

Baden-Baden's Kurhaus offers cure-seekers
a beautiful terrace from which to face the world.

Photographs by Farrell Grehan

Shrouded like a mystical order, the spa-goers receive bronchial inhalation at Augustabad.

Spa-goers stir circulations with a gentle stroll
on charming Lichtentaler Allee, Baden-Baden.

unhealthy air, a chance to meet old friends and make useful new ones, to display wealth (or young daughters) and, who knows, maybe turn a discreet business deal or two. The prestige of the spas reached an apogee late in the 19th century and continued almost unabated until World War I. Since then, everything has changed. Most spas are still in operation and many of them are even crowded and profitable. But the style will never be the same.

The innumerable combinations of natural minerals, gases and salts bubbling up in the different springs (there are literally thousands throughout Europe) may not have helped anyone lose his gray hair, but they have always seemed curative and regenerative. Today, in science-ridden 1974, the various branches of crenotherapy (from the Greek *krēnē,* mineral spring) are highly organized and officially sanctioned as important contributors to European health plans.

In the 19th century, however, spas had already become social whirlpools where the medical concerns of the habitués were secondary to various pretensions. Prince Charles Joseph de Ligne characterized some of them as he watched the life in Spa and came up with a list that would have to be only slightly updated to fit dozens of fashionable towns today:

"Names, titles and ridiculous faces; amphibious animals of the Church and the world, leaping and running . . . hypochondriac lords on melancholy promenades; Parisian girls entering the room in great bursts of laughter so that they will be thought charming and relaxed; young people of all nations pretending to be English, speaking through clenched and haltered teeth; round heads, black and filthy hair; bishops with their nieces; singing instructors and dance-masters in the uniform of Russian majors; Italians in Polish uniforms walking young roughnecks from that country; Dutchmen searching through gazettes for the latest exchange rates; thirty-six so-called Knights of Malta . . . a few old generals, retired for wounds they never received; Americans; mayors of all the local hamlets; escapees from all the prisons of Europe; charlatans of all types, adventurers of all species. . . ."

Probably the most famous spa is Baden-Baden, a neat, pleasant town on the edge of the Black Forest

Croupiers prepare the tables and chips in the opulence of Baden-Baden's casino.

in the southwestern corner of Germany. Fittingly, it owes its present grace and elegance to the French, those champions of creature comfort. Driven away by the French Revolution, many aristocrats who retained their heads gravitated just over the eastern border from Strasbourg, to the welcoming Grand Duchy of Baden. There these aristocrats took over building the residences, parks and public edifices, ineradicably setting the refined tone that Baden-Baden still bears.

"No city in the world has a face like Baden-Baden," says Eckhart Breiter, the municipality's enthusiastic young publicist. "We are proud of it and we are not going to spoil it. All the cities of the world have begun to resemble each other, so that is all the more reason to keep ours different."

Everything about Baden-Baden is manicured. The famous Lichtentaler Allee, the treelined promenade running parallel to the Oos, the elfin archetype of the babbling brook, is one of the prettiest parks anywhere. On one side it is bordered by those overgrown jewel boxes, the Victorian palace hotels, and on the other by great stretches of verdure which roll gently up to the massive stone fronts of the casino, an absolute masterpiece of sumptuous ostentation; the vast Trinkhalle, a temple of water ingestion; and the Kurhaus, the city's principal gathering place, where visitors gorge themselves on creamy, sinful cheesecake until they feel guilty enough to go wallow in a mud bath.

The medical element is strongly present in Baden-Baden. The 20 different hot springs have been found to be especially effective against rheumatism and arthritis, but also for circulatory problems, respiration and general fatigue. Even the locals pass dutifully through the mighty columns of the Trinkhalle, belly up to the brass spigots—methodically serious as only Germans can be—and walk away with a sparkling clean glass of *Friedrichsquelle*. Seated on a sensible bench, they sip through about a pint of the hot, foul-tasting stuff before picking up their shopping bags and striding out to confront life once again.

But it is not, finally, for medical reasons that people visit Baden-Baden today, any more than it was a century ago. *Die Kur* is an innocent lie, an excuse to come and live in satin lining for a few weeks, to feel elegant losing a couple of hundred marks in the casino, to revel in five-star servility and to tuck into some of the best cooking in Germany.

All this doesn't come cheap. Baden-Baden is one of the most expensive resorts in Europe and, as a result, most of its clients are older people with time and money to spare. It is a predominance that concerns the town planners, but there seems to be nothing they can do about it except make an effort to develop "the Baden-Baden Mix," a cocktail of comfort, gambling, amusement, food and gentle sport, all aimed straight at the prosperous old folks who like to wing over from Palm Beach and stroll around in their dinner jackets.

Carlsbad (p. 64) is Karlovy Vary now, because it lies

Rudolph Chelminski and Farrell Grehan are both frequent contributors to SMITHSONIAN.

Giant chess set, awesome to a youngster, challenges guests at the Haus des Kurgastes, Baden-Baden.

After the trials and exertions of a day at Baden-Baden, a little relaxation is in order.

within Czechoslovakia. The name is not all that has changed from the good old days. "The first thing a new arrival had to do," my already-quoted American correspondent writes, "was to buy a mug and bent glass straw for mineral water. The mugs came in different colors of cut crystal, ruby red, royal blue and clear, and of course some of them had *Karlsbad* etched on them, but my mother thought those were in bad taste. She had a clear crystal one she brought back year after year but the glass straws were always getting broken. You took an open horse-drawn carriage to the shops. Carlsbad was full of carriages, hardly anyone used cars. The horses had bridles wonderfully decorated with colored yarn pompons and all kinds of embroidered and crocheted arrangements, partly to keep off flies, I think, but mostly just for fun and status. Every coachman was trying to outdo the other."

They aren't trying anymore, and there are no more coachmen, anyway. Poor old Carlsbad has become shabby. Most of the gingerbready Maria Theresa-style buildings are still there, leaning their backs against the abruptly rising slopes which surround the little town, but the gaiety that their architecture was meant to project has disappeared. Many of them have been maimed and humiliated by the addition of steel-and-glass facades or wings. The gardens which used to girdle the Park Hotel and the Grand Hotel Poppe (now the Moskva) have been tarred over and made into parking lots. Vacationing workers take their water three times a day; they queue up at the great stone colonnade which houses the spring taps, fill their modern mugs on which the hollow handle serves as a straw, and then shuffle off to join the silent counterclockwise promenade, fists to their mouths, sucking away contemplatively.

A typical daily schedule was given to me.

6:00 A.M.—Reveille
7:00 A.M.—First mug of water
8:00 A.M.—Breakfast, followed by medical examinations and treatment, baths, massages or exercise
11:00 A.M.—Second mug of water
Noon Lunch, followed by repose
4:00 P.M.—Light sport, promenade or excursion
5:00 P.M.—Third mug of water
6:00 P.M.—Dinner
7:00 P.M.—Dance, concert, theater or film: culture-taking
10:00 P.M.—Lights out

Statuary from a grand epoch recalls the vanished glory of Carlsbad—now Karlovy Vary in Czechoslovakia.

A regimented line of vacationing workers fill their mugs dutifully with Carlsbad's famed water.

If those taking the cure are not back at their hotel by 10 P.M. on weekdays or 11 P.M. on Friday or Saturday, they find the hotel doors locked. To have them opened they must call the doctor directing their cure. Lack of a valid excuse means that national health insurance payments will be cut off.

If Czech spa life isn't all it used to be, much of the change is due to the Soviets, who generally set the tone for Eastern European crenotherapy. The Soviets take the waters with deadly seriousness. They claim to have invented the modern science of balneology and to have pushed the effectiveness of treatments.

Do the waters produce real benefits? The theory is that minerals and salts suspended in water flush out the kidneys, quicken circulation, ease the heart, free

stiff joints and carry out innumerable other cures. How much of it is true is difficult to prove, but the fact is that men and women have been flocking to the springs for centuries at least *believing* that they were cured. The mere fact that a worker gets away for a few weeks, exercises in healthy, unpolluted air, drinks more water than vodka and eats a balanced, nonfat diet is in itself a guarantor of improved health.

If Americans are to take to spas, though, something else is needed. Since the end of World War II, an energetic French entrepreneur named Adrien Barthelemy has been transforming five ruined old railway stations into the Chain of the Sun—a clutch of mini-country clubs—where tennis, swimming, horseback riding and even billiards count as much as the inevitable mineral waters. A stubborn percentage of guests at these updated spas prefer Bordeaux Rouge Supérieure to hot water, but the management neither flagellates them nor locks them out of their rooms for it. Barthelemy had the good judgment to turn three of the places over to three of his striking young daughters, with the inevitable result that young people are flocking to European spas once again after disdaining them for more than 50 years.

The smartly decorated rooms, the delicious country air (city slaves are always astonished to realize that fresh air has a *taste*), the amazing dietetic food and the absence of creaking exercise machines and geriatric glumness make for a feeling of well-being which must be, after all, what spas are all about.

At Spa, Belgium, from which springs the name, these visitors take their cures seriously, pampering bodies with soft luxury and minds with the knowledge that water is good for you.

England's monarchs, William I through George II, form 1787 puzzle. Portraits are ringed by historical facts (above) so that youngsters learn their lessons while putting it all together.

By William and Rita Vandivert

Past teaching aids in jigsaw puzzles

Two centuries ago, children learned geography from dissected maps. The idea now frustrates adults on rainy afternoons at the beach house

From all available evidence it appears that the jigsaw puzzle, the complications of which now drive addicts to frustration, was invented in a London printshop off Drury Lane by John Spilsbury in the early 1760s. His dissected maps, as he called them, were mounted on wood panels and cut into pieces. His trade cards made no mention of "dissected puzzles," but soon listed 28 dissected maps at prices ranging from seven-and-a-half shillings to the handsome price of one guinea (one pound, one shilling). Others soon copied Spilsbury's success. In 1789 a dissected picture puzzle was described on its box as "Suitable for the Instruction of Youth of all Ages, Designed to impress upon their minds a love to Virtue and hatred to Vice."

John Spilsbury's dissections were a classic case of an idea whose time had come. The materials were all at hand—engraved and hand-colored maps were in general circulation, thin panels of cedar, mahogany or white wood used in cabinetmaking were available,

At Powell-Waller House, Colonial Williamsburg, a young visitor studies another version of the puzzle.

and fine hand marquetry saws were to be had from the same industry. The public's purchase of newspapers, broadsheets, chapbooks and the recently introduced children's books supported a growing publishing industry. In English towns and among the well-to-do of the countryside, the education of the young was being pursued with increasing zeal.

Spilsbury, long apprenticed to an engraver who was printer and "Geographer to His Majesty," sold prints, maps and charts, engravings, picture frames, stationery and books such as Bibles, prayer books, almanacs and plays. Eventually he made a name for himself and launched his new invention. Although he died in 1769, dissected puzzles remained, for 20 years, limited almost entirely to maps and geography.

By the mid-1780s jigsaw puzzles began to involve less serious subjects. New ideas sprang from the popularity of the humorous broadsheets of the time. "John Gilpin" was a runaway success in 1785.

Puzzles made from broadsheet engravings were often accompanied by the folded broadsheet itself, packed in the box in case you gave up. The engravings were expensive, so this second use with puzzles became common practice. One of a popular series of six engravings of Sterne's *Tristram Shandy* was done about 1795 and has survived.

History puzzles joined geography. Then came alphabets, multiplication tables and natural history subjects. Many were concerned with moral uplift—the titles show the trend: "Bowles's Moral Pictures, or Poor Richard Illustrated. Being Lessons for the Young and the Old, on Industry, Temperance, Frugality, etc., by the late Dr. Benj. Franklin," "Pilgrim's Progress," "A Map of the Various Paths of Life" and a "Key to the Old Testament," which was the first of a whole series of Biblical subjects. For the first 40 years of dissected puzzles, it's a fair estimate that almost half were geographical, nearly a third designed

to amuse and perhaps a fifth heavily instructive.

Among English publishers who flourished on dissections into the 19th century were William Darton and John Wallis, who became the principal rivals. In 1787 Darton, a Quaker, set up as a children's publisher. One of his first offerings was a new form of dissected puzzle entitled: "Engravings for Teaching the Elements of English History and Chronology, after the Manner of Dissected Maps for Teaching Geography." His stern Quaker principles gave him a heavy touch, yet he turned out successful jigsaws until his death in 1819.

John Wallis' first outstanding success came in 1788 with a dissected puzzle based on Darton's, but simpler both in design and title: "Chronological Tables of English History for the Instruction of Youth." This lighter touch marked Wallis's approach throughout the career of his family publishing business.

It is uncertain when the first dissected maps and similar puzzles were introduced into the American Colonies. Agents of planters, merchants and shippers brought publications and other wares from England throughout the 18th century, and even with the break in commerce during the Revolution it is almost certain that puzzles, as new learning tools and recreations, were soon seen in the Colonies.

Last year at Colonial Williamsburg in Virginia a dissected map of Europe lay partly assembled on a rag rug among other toys in a child's room in one of the old houses. Its designer was described as "Le Sr. Janvier, Géographe à Paris, 1786. Avec privilège du Roi." In the Abby Aldrich Rockefeller Folk Art Collection, also in Williamsburg, are some of the best-documented jigsaw puzzles in the U.S. collections, among them the Darton history puzzle of 1787 (pp. 66-67) and associated picture puzzles.

To watch a child assemble interlocking puzzle pieces gives one an inkling of the lure that jigsaw puzzles have. It is a personal challenge which can only be met by completing the assembly. There is a primitive pleasure in fitting shapes together. And there is visual satisfaction in recognizing picture forms as they emerge and in completing the image. Children's puzzles have always been cut simply. The early ones had slightly interlocking edges, but without intricacy. After all, Spilsbury's tools were pretty limited and were slow to improve. Jigsaws were cut much the same way for almost the first century of their history.

Ephemeral is the word for jigsaw puzzles. Odds are high that pieces will be lost, and once any are missing the game is spoiled and the puzzle likely to be thrown away. Educational puzzles were more carefully treasured than amusing ones, so more of them remain. But most museum curators and antiquarians have shown little interest in early jigsaw puzzles. A few are stored away, sometimes not catalogued, rarely made up. This may be partly because it inevitably seems a waste of time to put all the little bits together just to see if any are missing, then break up the picture to put it back in the box again.

Fortunately, one determined Englishwoman has changed this, at least in Great Britain. She is Linda Hannas, wife of a Norwegian diplomat turned anti-

Mr. Vandivert ("Wytham Woods," May issue) and his wife are a photographer-writer team.

Handmade pieces come from two Par Puzzles, sold about 20 years ago, but now extremely scarce.

Figures were probably crafted by Frank Ware, now 70, until recently a producer of custom-made puzzles.

J. W. Barfoot, 19th-century English artist, signed his "Star of the West" with sprays of roses.

It depicts ladies and gentlemen riding in Hyde Park, among them a famous demimondaine of the 1860s.

quarian bookseller. They live in a spacious house in a London suburb with a handsome collection of English 18th-century literature and Norwegiana as well as nearly 300 historical jigsaw puzzles. The puzzles have a room of their own, fitted with special cabinets of shallow shelves to hold them in their made-up state. A glass-fronted case contains some of the best preserved boxes, and a number of framed beauties hang on the walls.

A collector of children's books and games, Mrs. Hannas came across a number of early dissected puzzles and realized she had a fascinating subject which had been completely neglected. She traveled all over England to museums and other possible sources, and in 1968 persuaded the London Museum in Kensington Palace to put on an exhibition, "Two Hundred Years of Jigsaw Puzzles," with many of her own to augment the Museum's collection. Her research recently appeared as a handsome book, *The English Jigsaw Puzzle 1760 to 1890.*

In this Mrs. Hannas describes, among other things, how she began to notice a number of unidentified mid-19th century puzzles with certain common characteristics. They were double-sided, usually with a map on the reverse side; they were on three-eighths-inch wood, twice as thick as the usual backing; there was a similarity in the cutting. The subjects—children, grown-ups, animals, birds—were all executed with taste and skill, but were unsigned. One particularly beautiful puzzle which she felt sure belonged to the group was "The Star of the West" (p. 69), a colorful scene of lady and gentleman riders in Hyde Park. This scene was adorned rather oddly with trails of pink roses, and Mrs. Hannas was sure she had seen them before on several puzzles, sometimes dropped in incongruously. Could they be an artist's signature?

Further research led her to a name—Barfoot. She discovered that a whole family of Barfoots might be involved, but with dogged checking of parish records, wills, census returns and street directories she finally identified a father and son of that name as respected miniature painters. She even tracked down their house in Islington where they had quietly expanded from designing puzzles to doing the lithographic work and the complete manufacture of puzzle and box. Her ingenious and well-documented theory was that they fell on hard times as miniaturists and anonymously took to "trade." Her guesswork was completely vindicated when an old puzzle arrived in the mail as she was reading her book proofs. It showed roses—and a clear signature: J. W. Barfoot.

Among early U.S. jigsaw puzzles the dissected map, as in England, was a favorite. One perfect specimen is in the hands of the American Antiquarian Society at Worcester, Massachusetts: "McCleary & Pierce's Geographical Analysis of the State of New York," a map on wood made in Albany in 1850.

Milton Bradley Co. and McLoughlin Brothers entered the game business in the 1860s, and both published excellent maps, well mounted on wood. Maps continued as a staple, but the fare soon broadened. McLoughlin, particularly, sold boldly colored scenes of locomotives and horse-drawn fire engines. One of

Abby Aldrich Rockefeller Folk Art Collection, Williamsburg

"Metamorphoses" amused puzzle fans around 1850. Interchangeable triangles switch costumes and faces.

Left: "Componium Pittoresque" allows almost limitless number of views (estimated at more than 200,000) to be composed by arranging 36 pieces within a frame which holds three strips at a time.

Bradley's puzzles announced on its box, "The Smashed-Up Locomotive." When assembled, the picture was a resplendent locomotive quite intact!

In the Smithsonian Institution's own collection is a well-preserved set of scenes from the Centennial Exposition in Philadelphia. Published by George H. Chinnock of New York in 1875, the box lid reads: "The Great American Centennial Exhibition/Puzzle Blocks in Sectional Parts/Endless Amusement" (pp. 72-73). In one box are five jigsaw puzzles on wood and their key pictures showing the Art Gallery, the Machinery Hall, the Horticultural Hall, the Agricultural Hall and the Grand Opening of the Main Building.

"Jigsaw" refers to the machine saw with a reciprocating vertical blade used for fine scroll cuts. As this machine was refined, toy manufacturers used it not just to cut single puzzles, but two to four stacked sheets two to four at a time. Even so, labor and wood costs were still appreciable, so toward the end of the 19th century puzzle illustrations were frequently mounted on cardboard and die-cut in special presses. The dies were not cheap, but increasing sales to the larger markets more than made up for the costs. With cheaper production, jigsaw puzzles soon penetrated the home as advertising premium deals. "Hood's Rainy Day Puzzle" (p. 73) was distributed around 1890 in return for wrappers of Hood's Sarsaparilla cures.

Both in the United States and in Europe jigsaws were using color lithography more and more from early in the 19th century. One of the gems still extant from 1829 was published by M. Trentsentsky in Vienna, Austria, entitled *"Chinesische Bilder"* (Chinese pictures). Its soft colors depict five Chinese children at play under a grape arbor. At the same time other kinds of picture puzzles became popular. A "continuous landscape" of 36 interchangeable strips (above) was published in lithography in Paris in 1825. A frame was provided which could hold any three strips as a completed view. Its maker claimed that twice as many views could be composed as there were words in the French language!

"Metamorphoses" were popular, too. These were printed paperboard figures whose tops and bottoms could be interchanged to form humorous combinations. Some appeared as sets of wooden blocks with parts of pictures pasted on all six sides. In America McLoughlin Brothers published a popular set of metamorphoses, "Mother Goose's Magic Transformations," around 1875. Color-printed cardboard strips had to be fitted together to illustrate nursery rhymes like Jack and Jill and Tom the Piper's Son.

In 1909, Parker Brothers of Salem, Massachusetts,

which had been cutting dissected map puzzles for almost 20 years, struck a bonanza when they began using reproductions of paintings in a jigsaw form they called Pastime Puzzles. Some of them ran to 1,200 pieces and all of them included some pieces cut into recognizable shapes like bulls' heads, lobsters, snowflakes and stars.

Years later, Orson Welles fitted one such blockbuster of a jigsaw into his film, *Citizen Kane*. Kane's breakup with his second wife is presaged by a scene in his palace where she plucks listlessly at a huge unfinished puzzle on the hearthstone as he paces by.

The Depression saw a surge in jigsaw puzzles to fill time in jobless periods. The British publisher of Beatrix Potter's children's books, quietly proud of the firm's record of never having fired an employee because of the Depression, recounts that, while book sales were fading in the early Thirties, every idle hand was put to work on both juvenile and adult jigsaw puzzles, either gluing, cutting, or boxing and shipping. They are still selling Peter Rabbit jigsaws today.

Thrown out of work, many handymen or designers set up small jigsaw puzzle businesses in their basements. Few made a good living, but one in New York City has lasted until May 31 of this year as the Rolls Royce of the business. Frank Ware, and his partner, John Henriques, not only survived, but under the name of Par Puzzles (pp. 68-69) developed the world's most expensive custom trade of individually hand-cut puzzles among the rich and famous. One wealthy Californian reputedly paid $2,000 for a Par Puzzle of more than 2,500 intricate pieces.

As part of Par's survival kit, the two partners ran a jigsaw puzzle club, but closed it when its chores finally got too irksome. Another puzzle club is still going strong in Herefordshire, England, where 4,000 jigsaws are available to subscribers, neatly boxed in plain brown and ranging from 90 to 3,000 pieces. But running a jigsaw club has problems. Each puzzle has to be logged in and out and checked for missing pieces. Postage costs keep rising and so do puzzle prices, yet membership shows no signs of falling off.

What makes a puzzle person? In part curiosity, certainly plenty of spare time, and possibly love of order. There may also be nostalgia for the remembered delights of puzzle-solving as children. Enough of this mixture and you have an addict, getting through three or four puzzles a week, as some do.

Jigsaw fashions change. Once again fine art puzzles are "in" for adults. Instead of being backed on wood, they are almost all on die-cut cardboard. But the die-cuts are far more complex than hitherto. Investment in a single set of dies can be astronomical, but by using long runs of the same die and keeping the same size format for different pictures, publishers can produce jigsaws in quantity quite cheaply.

Today, puzzle sales are rising. Perhaps inflation and the high cost of outside entertainment are keeping people more and more at home. There are no official figures on the volume produced in the United States, but one industry leader estimates that retail sales here run to more than $150 million annually. From a small venture that began 200 years ago in a printer's shop on a little street off Drury Lane, that's something.

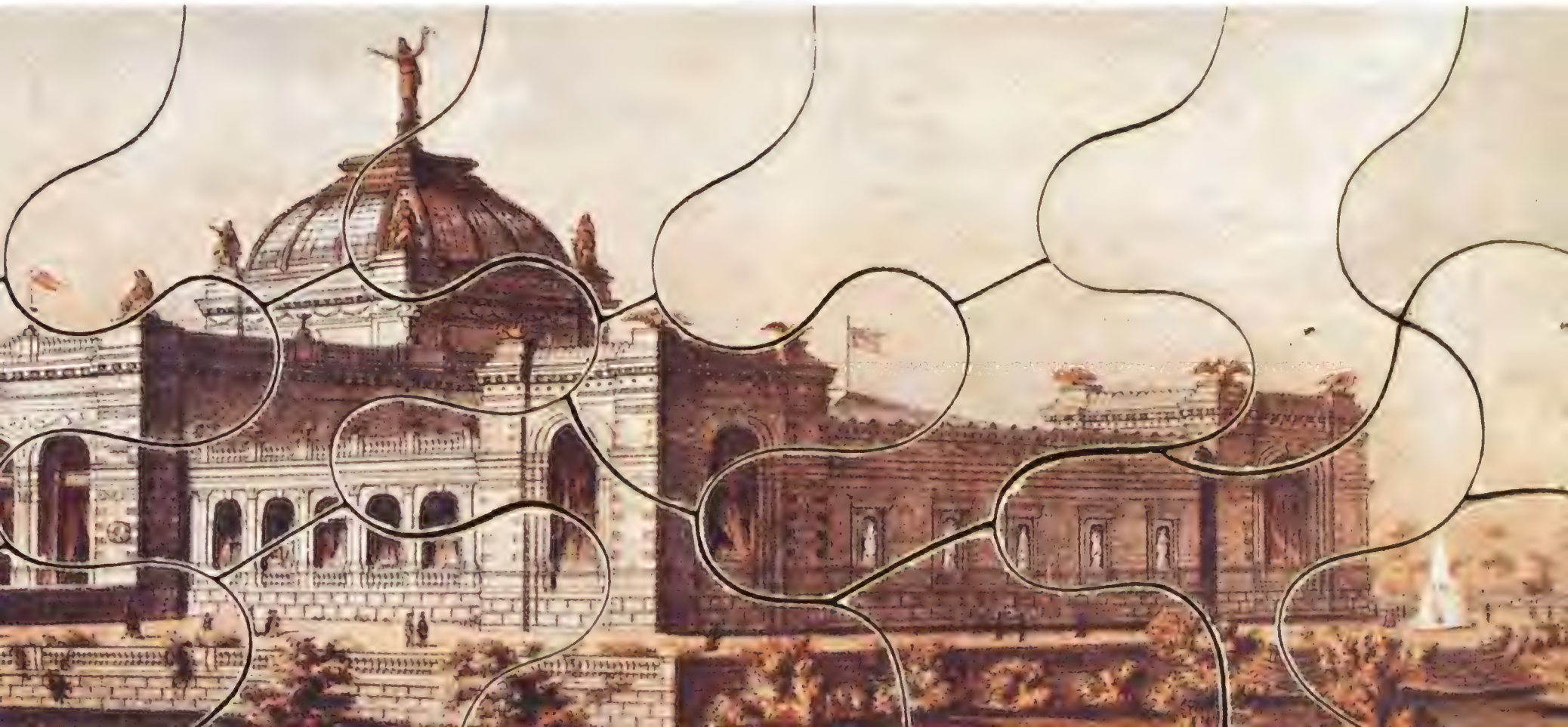
Parents are still buying dissected maps to help their children learn geography. As cartographers remap the boundaries, so do the jigsaws change. The newest dissected puzzles of the familiar map of the United States now have insets to include Hawaii and Alaska. And if parents are anxious to encourage their children to travel farther afield, they can buy them puzzle maps of the Paris Métro and the London Underground.

Museum of History and Technology, Smithsonian Institution

Rockwell Gardiner Collection, Stamford, Connecticut

HOOD'S SARSAPARILLA LABORATORY. C.I. HOOD & CO. Proprietors
THIS ENTIRE BUILDING DEVOTED TO THE BUSINESS OF HOOD'S SARSAPARILLA.
HOOD
GET HOOD'S AND ONLY HOOD'S
Hood's
Hood's Sarsaparilla
HOOD'S SARSAPARILLA CURES
HOOD'S SARSAPARILLA RAINY DAY PUZZLE
"THAT'S THE MEDICINE I TAK
PECULIAR TO ITSELF

Hood's Sarsaparilla offered this unlikely view of its plant in return for three wrappers.



Art Gallery of the Centennial Exhibition is displayed on this 1875 puzzle at the Smithsonian.

By Ernestine Norsgaard
Photographs by Campbell Norsgaard

Insect colonies exist by living as one organism

Over the eons, social insects have come up with cooperative living arrangements that help the group, not the individual, survive

A *Polistes* paper wasp queen tends her first eggs in a small comb she has constructed by herself. Two

Social insects—ants, termites, paper wasps, bumblebees and honeybees—cannot function as individuals. For one thing, the working class is sterile or lays eggs that hatch only males. Termite and ant soldiers and honeybee drones cannot feed themselves and are cared for by workers. A single termite is helpless, but thousands cooperating together build air-conditioned structures in Africa and other tropical areas that are sometimes mistaken for human villages. Pooling their resources, some ants gather and thresh seeds; others raise "cattle" from which they milk a sweet honeydew. Some ant species hunt as well-organized armies. Exile from the colony is fatal to a social insect.

In social insects, the group instinct has advanced to the stage where members of a colony seem to be in the process of becoming parts of a single body. Individual members are bound to one another by physical connections, such as the exchange of glandular secretions, and bodily adaptations to do specialized work. The colonists cannot survive without one another.

This was not always so. Highly organized insect societies have developed over many millions of years. Two hundred million years ago, ancestors of today's ants were winged insects that hunted alone and slept in their separate shelters. In time, a brood appeared whose females had weak wings that snapped off after the first few flights. But they were able to find enough food on the ground, and they survived.

Small groups began to stay together each night in little hollows which they dug. Adult ants flew soon after emerging from their cocoons. Their first flight usually turned into a mating chase, the forerunner of today's mass-marriage flights. They often landed far from home. Because the females' wings soon snapped off, they had no choice but to stay and be pioneers in a new territory. In this way, their communities spread far and wide. The grublike ant larvae did not get the "tender loving care" the young get today. They had to grab bits of food brought into the nest by adults and feed themselves.

But an important thing happened that led the ants to become much more cooperative. The larvae developed a gland near their mouths and their skins became moist. Adult ants liked the flavor of the liquid that oozed from the mouths of the larvae when they

eggs are visible. When the first brood reaches maturity, they will enlarge the nest and feed the larvae.

were fed. Some adults started feeding and licking the larvae to get this fluid.

Millennia passed while these simple communities changed into complex societies. Different castes developed their special roles. Fossils of them have been found in amber dating back 100 million years.

In the behavior of some of the solitary bees and wasps we can see early stages of a social process. Large numbers of mining bees often build their separate nests so close together in the ground that they use the same passageways to the outside.

A paper wasp queen becomes more specialized as the season progresses. In spring, she builds a small nest, lays eggs and then gathers food for the larvae herself (above). When the first brood of daughter-workers is ready to enlarge the comb, hunt for insects and feed the larvae, the queen concentrates on laying more eggs.

There are even some primitive ants living today, just as some human tribes still live as their Stone Age ancestors did. The ponerine ant queen is not as specialized as the queens of more highly developed species. She does not seal herself into a cell to raise her first brood, but goes out to hunt insects. The workers of most ponerines do not exchange food with each other, and thus lack a subtle form of chemical communication used by more sophisticated species.

The exchange of food within colonies of social insects, called trophallaxis, is far more than a charming social formality. A droplet of fluid passed from the mouth of one ant to the mouth of another carries a chemical message. It contains a mixture of glandular secretions received when attendants and nurses lick the queens, eggs and larvae, storing the juices to exchange with other ants. This mixture is stored in special stomachs or "crops." Below the crop is the ant's personal stomach where her food is digested. The two stomachs are separated by a valve which allows only one drop of food to pass through at a time.

With antennae in elbowed embrace, one (or both ants) gives the other a taste of the food stored in her crop. For a moment the droplet is poised between serrated spoonlike jaws, then it is swallowed, modifying the mixture already in the crop.

In some ways, the exchange can be compared to the circulation of hormones in a body, giving orders and information to the cells.

The bodies of all higher animals are communities of individual cells. Their ancestors were able to live independently more than a billion years ago. It seems that the same developmental process is continuing on the next level. A honeybee hive is more than a community of individual bees. In many ways, it is like a single body.

Honeybees' glands are acutely responsive to the needs of the colony, even causing a worker to revert to functions of a previous stage if necessary.

A honeybee worker changes her occupation as she grows older. When a gland in her head begins producing a protein-rich liquid called "royal jelly," she becomes a nurse and feeds the larvae. When her wax glands enlarge, she begins making wax and building cells. She spends the last part of her short life going out to forage for nectar and pollen.

But the time schedule for changing jobs is flexible. Nurses can maintain their feeding glands past the usual time. Old foragers have reactivated their wax

Ernestine Norsgaard is an artist; her husband Campbell makes films. Together they have produced 50 films on nature topics for school use.

glands when new cells were urgently needed. If the well-being of the colony requires it, young bees can speed up their advance to the next stage.

Individual bees age and die, but the hive-body lives on.

Exchanges of food take place from nurses to queen, nurses to brood, foragers to housekeepers. Each bee stage contributes its own glandular secretion. The exchange circulates information through the communal body, acting upon the nervous systems of its members.

In this way, for instance, the many thousands of bees in a hive know that their queen still lives and functions. While grooming her, attendants receive the special substance secreted from the queen's mouth and spread on her body. Their supply passes from bee to bee, informing each one that the queen is still there.

If the queen dies or the colony grows very crowded, the queen substance becomes so diluted that its message no longer reaches all workers. Some will then alter one or more worker brood cells into emergency queen cells and feed the larvae only royal jelly, with the object of rearing a new queen. If the old queen still lives, she will leave in a swarm with about half the overgrown community to build a new hive. This usually happens after warm spring weather arrives and food is abundant. The queen lays large numbers of eggs and the population of the new hive grows so rapidly that it may reach 70,000 in six weeks.

The queen, in turn, gets messages about the colony when her attendants extend their tongues and feed her. On the basis of this information, she deposits eggs that will hatch into female workers or male drones. If she allows some of the stored sperm which she received during her marriage flight to reach the egg as it slides past her sperm storage pouch, it will develop into a female. If she withholds the sperm, the egg develops into a drone.

A failing queen, whose egg production drops, will be replaced. Some bees inspect her work as she lays her eggs. They surround her as she examines each cell to see if it is empty and clean and then lowers her abdomen into it. Afterward, a few peer into the cell, spot checking, as it were.

The termite queen is no more the ruler of her col-

Adult ants tend their larvae. The larvae secrete a liquid from their mouths and bodies; adults like this fluid, so they feed larvae bits of food to get it.

Some dairymaid ants raise aphids and sapsucking insects that provide them with honeydew. They "pasture" corn root aphids in underground nests.

ony than the honeybee queen. In fact, she lies quite helpless, having become even more specialized into an egg-laying "machine," a hugely swollen ovary. Of the social insects, the termite is the only queen whose consort lives to help her establish the colony, remaining by her side through the years and witnessing the startling change in her once svelte figure.

It would seem that insect communities are governed by the circulation of "social hormones," but this is only part of the story. There are other ways that the beehive "body," for instance, keeps itself in balance. Sometimes when a lot of nectar is brought into the hive, there aren't enough empty cells to store all the honey that is being made. Then the housekeepers must keep the extra honey in their honey stomachs. More sugar passes into their own systems than they can use as energy. This causes their wax glands to transform the excess into wax. They use the wax to build more storage cells and, *voilà*, the problem no longer exists.

Among termites, the exchange of food determines whether a nymph will grow up as a worker, a soldier or a member of the royal caste. Which caste it will be is controlled by a substance in the food fed to the very young by nurses. In licking other termites, the nurses receive hormones produced by the glands of members of the various castes. Each caste produces a somewhat different substance. This mixture gets into the food fed to the nymphs and inhibits their growing up in any caste that already has enough members to satisfy the needs of the colony at that time. If the queen, king and soldiers are already there, the nymphs develop into workers. There can never be too many chiefs and not enough Indians.

Much social behavior is instinctive, having been "preprogrammed" into the insect's brain. Leaf-cutter ants cultivate and fertilize their fungus gardens in a compost of chewed leaves, using the same agricultural techniques as their ancestors. On her marriage flight the queen carries along a bit of her special fungus, a behavior she could not possibly have learned by watching another queen.

Each spring, young paper wasp queens construct the first dozen or more cells of their communal nests without help or instruction. They are born experts at chewing wood into pulpy papier-mâché and making the same hexagonal cells perfected by their species in times long past.

And then, using the evidence of their senses, the social insects react to their environments. It has been demonstrated that some ants have memories and can learn to find their way through mazes, avoiding false turns on subsequent trips.

Some ants are more alert than others about what needs to be done. They don't give orders but lead by example. They are the first to go out hunting for more food if the larvae show signs of hunger, and the first to recognize danger. Because they become active and excited, moving quickly and gesturing with their feelers, they excite others to action and they are called "excitement centers." Ants are extremely sensitive to each other's slightest vibrations. One excited ant in-

Naked pupae of certain ant species are unprotected by cocoons. All stages of growth are seen here, from white legless larvae to the darkest, most mature pupae.

Here dairymaid ants try to prevent aphids and one winged reproductive from leaving the nest. The reproductive will be pushed, the aphids carried back.

Carpenter ants on a piece of wood exchange a shiny droplet of food from mouth to mouth, a process

fluences others who spread the excitement through the colony.

An insect's responses to its environment are limited and largely instinctive. However, certain behavior, especially among ants and honeybees, can only be ascribed to intelligence.

One day I watched a large carpenter ant walking around and around the rim of a ginger-jar lamp, following her own scent trail for about seven minutes. At first she walked with lively step as though confident of getting somewhere. After some dozens of times around, she paused uncertainly, her jauntiness evaporating. She tapped the china surface with her antennae. She made a few more rounds, then stopped and sat up to clean the dust off her antennae by pulling them through grooves in her front legs.

When she resumed walking, it was in the reverse direction. A second, perfunctory antennae cleaning followed soon after the first, as though the trouble might lie in a faulty sense organ. An ant has no nose; her feelers are organs of smell. She is able to distinguish between fellow colonists or intruders because each ant has the special body odor of her colony. An ant "marks" a trail to a source of food by periodically lowering her abdomen to the ground and leaving a glandular secretion which her sisters follow.

After the second grooming, the carpenter ant began walking with much hesitancy and tapping; then she walked *under* the rim and around the bulging surface of the lamp a few times. Stopping at the edge to look down the steep drop, she drew back sharply, and then walked around in a gradually descending spiral until she reached the table.

I may be projecting my own feelings, but I had the distinct impression of a creature becoming aware that the scenery was all too much of a sameness, and trying to figure her way out.

Honeybees do not have leaders as such; every forager is a scout. Most authorities agree that scouts communicate their findings by a specific language which is a type of charade.

If a source of food, say a berry bush in flower, is within 100 yards of the hive, the forager does a "round dance." She whirls rapidly in a narrow circle, now clockwise, now counterclockwise. Those nearest take up the dance, following closely on her tail. Other clues are sample droplets of nectar and the scent of the flower, which clings to her. At the bush, she has left another clue, her own scent from an organ near the tip of her abdomen.

If the food source is farther than 100 yards away, the dancer must let her fellow foragers know exactly how far and in which direction to fly. For this, she does the "waggle dance," a fat figure eight, wagging her tail only during the straight runs. The number of figure eights danced within a given time tells the distance. The nearer, the faster she dances.

The direction to fly is the direction the dancer faces when she makes the tail-wagging run between the loops. If she runs straight up the comb, the food is in the direction of the sun. Straight down the comb means away from the sun. Upward at 45 degrees to the

called trophallaxis. Third ant waits its turn in the give-and-take of communication via food.

Termite nurse gently strokes nymphs whose caste will be determined by glandular secretions in food.

left means that on leaving the hive the bees will fly 45 degrees to the left of the sun.

(These interpretations are in the nature of examples. There is some evidence that bees in different countries have their own "dialects" and often misunderstand each other's dances.)

The dance is also performed when a swarm of bees is deciding on a site for a new hive. About half of an overcrowded colony follows the old queen, clustering around her when she settles on a branch or even a traffic light. There they may hang for hours or days while scouts fly here and there, searching for a likely place for a new hive.

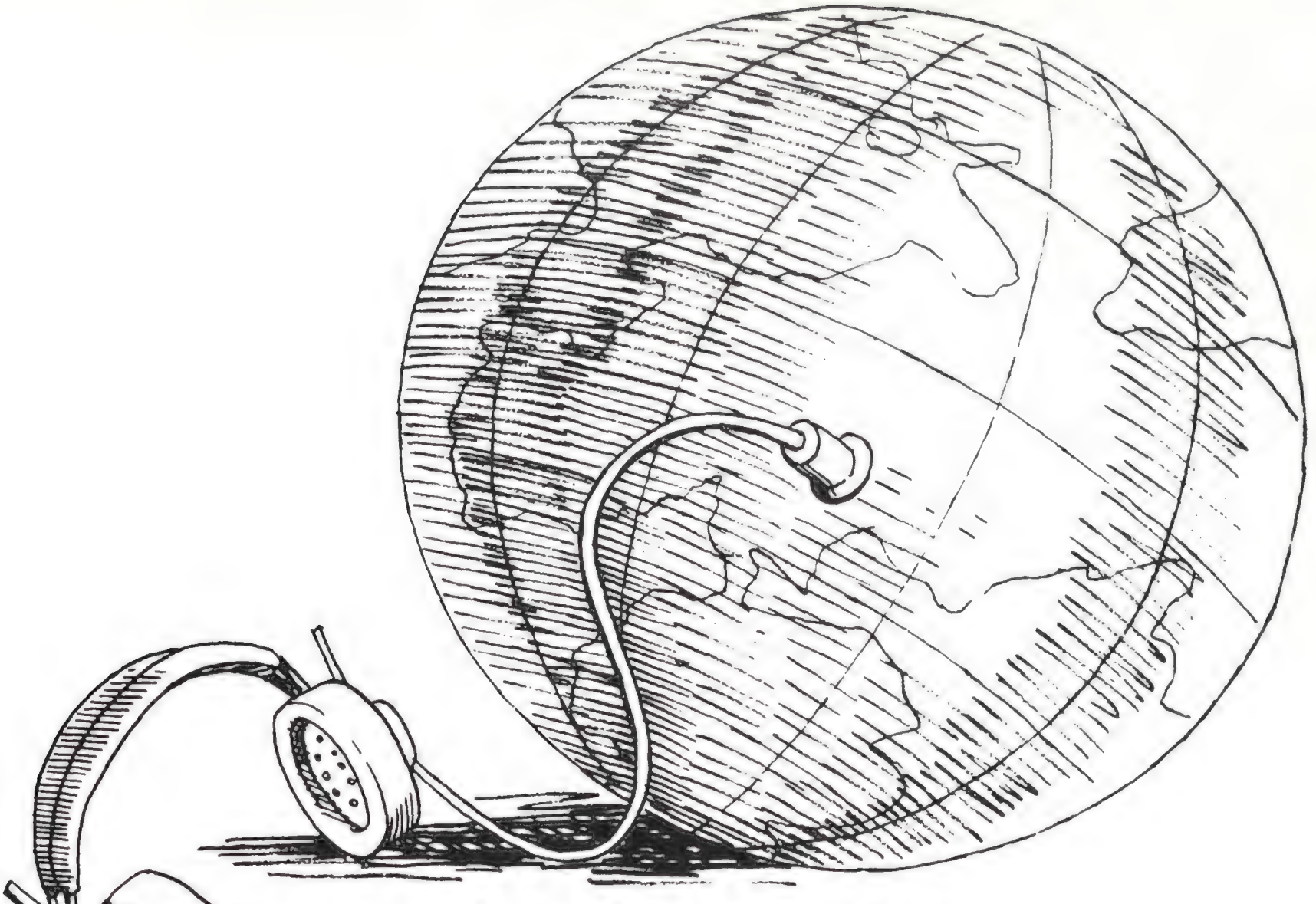
Returning scouts give precise directions to a recommended site by dancing on the cluster. Enthusiastic dancers arouse more followers to inspect the site. If these approve, they repeat the same directions in a lively dance on returning. Dancers publicizing less worthy sites switch their votes after inspecting the best site. So much for the myth of a totalitarian bee society where individuals have no voice. Not until all scouts agree by dancing the same dance does the swarm leave for the selected location.

A moment before the swarm leaves, the air vibrates with increased buzzing and excitement. Within a few seconds, the swarm has broken its hanging formation —bees peeling off in layers. The last to leave are those hanging on to the branch itself. The whole cloud of bees flies together, guided by the hundreds of members who already know the location. In this way, the hive reproduces itself by division just as a one-celled animal does. Colonies die through disease, famine or other disaster, so if there were no new colonies, bees might become extinct.

The social insects are about 150 million years older than humans in development. But, recent as it is, human history also records increasingly complex social organization and communication. Where will higher levels of social organization lead our descendants? We can only gather clues from past development. But even today, all living things on this planet are, in a way, members of the greater body of Earth. We couldn't live without green plants to provide us with oxygen and food any more than honeybees could live without flowers.

To consider ourselves, the insects and all life as many species living in a single body may seem strange, yet our own individual bodies include more than one species. These are not just the different cellular forms, such as round blood cells and elongated nerve cells, but also such diverse life as the fungi and bacteria which control each other's populations in our intestines and help digest food. In the same way, when we observe a formidable creature such as the yellow jacket on the next page, and then realize that it depends on life in a colony to survive, it can help us to understand life on Earth as the colonial existence of what we may someday consider one single organism.

In fall when nectar is scarce, a yellow jacket (12 times actual size) eagerly sucks syrup on the authors' porch. But only the queen will survive the winter.



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Atlas World Press Review
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New York, New York 10036

By Charles E. Little

Empty lots bloom in nation's cities

Community gardeners harvest food for the table, beauty for the neighborhood, an intangible sense of achievement

By 1944 there were 40 million Victory Gardens in the United States. Today, such gardening still lives. It has found especially fertile soil in the congested low-income neighborhoods of our large cities.

But today's garden in the inner city is as likely to have flowers as vegetables to brighten up the drab wastelands of public housing developments, school yards and vacant lots. In the parlance of the Seventies, such efforts are called "community gardens."

Often sponsored, or a least coordinated, by local government agencies, gardens are likely to bloom on almost any spot of land that is not covered with concrete. In Chicago, for example, community gardening has blossomed in the public housing projects (as in photograph at right), on several hundred vacant lots pin-pointed by urban renewal officials and even alongside more than a score of firehouses.

The gardeners fall into groups as diverse as their gardens. In many cities gardens are divided up into plots, each leased to a family. Many other gardens are group projects, with everybody sharing the work and the rewards. The groups, such as tenant organizations, senior citizen clubs, Boy and Girl Scout troops, tenant patrols and so on may have already been in existence or they may have been organized specifically to care for the garden. The methods don't seem to matter: Community gardens are springing up across the country.

So remarkable has the growth of gardening seemed that a non-profit organization, Gardens For All, has been set up in Charlotte, Vermont, to monitor the community gardens movement, collecting and disseminating case-history information. (GFA has its own experience to offer, too. Two years ago it helped get community gardening started in Burlington, the nearest city. That program, like so many others, has grown rapidly.) Last summer, Garden Way Associates, an enterprise that sponsors GFA, commissioned the Gallup Poll to find out how widespread the urge to grow vegetables has become. Gallup found that nearly four out of ten households in the United States grew some of their own food in 1972. As for community gardening, Gallup found that 59 percent of adults interested in gardening, but without land of their own, indicated they would be interested in using a community garden facility. This turns out to be a significant fraction of

Chicago. In a small fenced-off area of the Robert Taylor Homes, volunteers tend a flower garden.

Last year there were two gardens at the project; this year there are 13. Gardens are not vandalized.

the U.S. adult population—nearly 18 million people all told, most of whom live in cities.

The Gallup findings indicate the likelihood that community gardens in U.S. cities will be increasing at a substantial rate for a variety of reasons, perhaps for some years to come.

The tangible benefits are, of course, important. Fresh produce is getting harder and harder to come by, as truck farms at the edge of cities give way to leapfrogging housing developments, and agriculture becomes more and more dominated by agribusiness, whose monoculture requires long-distance shipping for many items at the grocery store. Another consideration showing up in much of the research is the potential savings in grocery bills. According to Derek Fell, executive director of the National Garden Bureau, a 12-by-25-foot plot and about $9 worth of seeds can save a family of four $250 on food bills. Thomas Fegely, writing in *Environmental Action Bulletin,* supplies this economic report from the Cleveland school program: "I really raised my eyebrows when I learned that in 1972 an outlay of $12,300 for 17,349 plots yielded over $400,000 of fresh food for the families of these 'midtown farmers.' "

The price of labor in these calculations is, of course, a "sunk" cost, as the economists would say. And for a family that must buy all the necessary tools, plus extra quantities of fertilizers and soil conditioners, the first year's returns can be a lot lower. (A "big ticket" item like a power tiller can quickly put you in the red.) But the investment in the soil as well as the tools can pay dividends for years to come. The potential advantages are persuasive to millions of Americans. According to the Gallup Poll, if the nation's nongardeners could be convinced that they can save $200-$300 by having a vegetable garden, nearly half say they might start one.

Community gardens of any kind take a lot of work, and not just digging and hoeing. In Minneapolis, a floating group of dedicated local government agency employees, civic leaders and students try to work out a coherent program for the whole city. Land is sought from various sources, including the highway department and the housing authority. To get it, the bureaucratic ladder has to be climbed. Then participants have to be organized. The Committee on Urban Environment works with the Community Design Center, a student-run service to low-income areas. The county agent counsels on how and what and where to plant. Somebody arranges for the land to be plowed and disked. Somehow the water problem is solved. Somebody knows somebody at Northrup King, the seed company. It comes through handsomely with packets of seed and a small packet of money, too. Garden clubs are asked to help. Somehow it all gets done. A community garden comes into being.

"Growing your own" can have social effects as well. Gardening can create trusting, functional relationships, particularly among people from different socioeconomic groups, says Mrs. Norma Olson, Vice Chairman of the Minneapolis Committee on Urban Environment. Her observations are based on a cooperative gardening effort in her own neighborhood.

Prospect Park, in southeast Minneapolis, is comprised of the Glendale public housing project and the homes of University of Minnesota faculty members and business and professional people.

Residents of that community, urged on by Mrs. Olson, have been helping each other with their gar-

Charles E. Little is a senior associate at the Conservation Foundation in Washington.

dens for several years (below, left). "Joint efforts in gardening show people from distinct social groups that they *can* work together. The sharing of knowledge, resources and help are natural kinds of human interaction," says Mrs. Olson. The community garden club members found they had other things in common, and wrote a cookbook together. The sale of the book has given them enough money for extra gardening materials and field trips.

In some cities, plot gardening dominates. Milwaukee, for example, started a program on unused city land in 1972, making 175 plots available to residents for a rental fee of $5 per plot. An outgrowth of the city's beautification program begun in the mid-Sixties, the gardens were a project of the county's Extension Service with the University of Wisconsin. Last year another site providing 680 garden plots was added, and this summer a third location brought the total capacity to 1,500 30-by-30 plots (opposite page). So popular is the program that when Lee Hansen, the Milwaukee County Beautification Agent, asked gardeners at the end of last year's season to fill out a questionnaire, almost all participants complied with detailed responses. Perhaps the most telling finding was that 97 percent of the 1973 participants wanted to have a vegetable plot in 1974. Two major benefits perceived by the Milwaukee plot gardeners centered on the tangible—an opportunity to have fresh-picked vegetables for the table and for canning and freezing, plus the opportunity to save on the grocery bills. Respondents noted that just as important as these were the intangible benefits, such as family togetherness, getting fresh air and sunshine, the educational benefits for the children and just enjoying "seeing something grow." In fact, the intangible benefits were seen as more important in the aggregate than either the utility of the produce or the cost savings.

In Palo Alto, California, ecology, economics and vegetables have been brought together in a gardening technique known as the "Life-Giving Biodynamic/ French Intensive Method." As promulgated by Ecology Action of the Midpeninsula, Inc., the method "stresses the use of raised beds, companion planting, close plant spacing and natural insect controls." In practice, the yield can be stunning (right). "The results of research begun by Ecology Action in July 1972," they report, "on alkaline, clayey soil containing almost no nutriment, may eventually mean that the small farmer in or near an urban area will be able to make an income of $6,000 per year on as little as one-fifth of an acre, depending on the length of the growing season in his area and the types of crops grown."

From such spontaneous roots as these, the community gardening phenomenon has been burgeoning in most major cities of the United States (as well as in many that are not so major). In Boston, home of Fenway Gardens, a Back Bay Victory Garden started in 1942 that survives to this day, there is a move afoot to establish a state Office of Garden Allotment, which would inventory vacant publicly owned land throughout Massachusetts and administer its use for community gardening.

Another category of the community gardening movement in the cities is "youth gardening." In Cleveland more than 4,500 schoolchildren rent plots on a total of 32 acres of land provided by the Cleveland Board of Education. Altogether, the Cleveland public school program has more than 21,000 children participating in what they call "Home and School Tract Projects."

Minneapolis. Neighbors in the Glendale Homes project in Prospect Park work together on the design of gardens. Children are encouraged to participate.

Another leading youth-gardening city is Washington, D.C., where the Washington Youth Gardens, started in 1963, now provides 45 playground sites for gardens around town, as well as a major installation at the National Arboretum and two demonstration centers (see photograph, p. 87). The total budget for this enterprise, which now involves more than 1,000 children, two professional horticulturalists and a score of volunteers, is $33,000 per year. According to Youth Garden Council Director Bill Hash, there is almost no vandalism. Hash gets the land plowed, provides the seeds, counsels and advises as he moves from garden to garden, makes presentations in the public schools, and wonders how to accommodate all the enthusiasm.

Perhaps the most dramatic city-wide flowering of urban community gardening can be found in the public housing projects of New York City. In 1963 the housing authority introduced a garden contest, and small plots of flowers, some with vegetables mixed in, appeared on project grounds all over the city. In the first year, a thousand residents in 105 garden groups in 65 developments took part.

The program was given an indirect boost by Mrs. Lyndon Johnson's beautification campaign, so that by 1966 there were 156 groups; last summer a record-breaking 496 groups participated, and this year there are more than 600.

According to Beatrice Friedman, manager of the competition, the "ghetto areas have the prettiest and the best gardens." She cites especially Harlem and the Brownsville area of Brooklyn.

The question that springs to mind instantly when

Milwaukee. Families plant 30-by-30-foot plots on a 20-acre site near the county institutions on the west side of the city. The plots rent for $5 a year.

Palo Alto. A California group is experimenting with the Biodynamic/French Intensive Method, which includes planting in groups, not rows.

one thinks of the housing projects—or almost any place in New York City—is vandalism. "We have had very, very little," Mrs. Friedman says. "The gardens are just something you don't mess around with. In fact, where there are gardens, there is less vandalism overall."

Community gardens in New York are not, of course, limited to the housing projects. The Parks Council has been coordinating support of various kinds of gardens in all kinds of neighborhoods (p. 88). Organizer Peter Grey, a former Chamber of Commerce executive, says he is in touch with 80-odd groups in the city. The fact is, says Grey, that "New York soil is bloody good soil." His groups include everything from street gangs to middle-class block associations.

One of the Parks Council's best known operations is "The Greening of Ruppert." New York beer drinkers will recognize the name Ruppert—the garden is on the site of the old brewery, demolished some years ago, at 93rd Street and Third Avenue. Once rubble-filled derelict land, it now contains 80 garden plots of 10-by-20 feet, plus grass and landscaping and a playground to keep the toddlers from underfoot. The participants at the Ruppert Green—rich, poor, black, white and Puerto Rican—are as varied as the vegetables and flowers they grow.

For Mrs. Anna Hammond, the benefits are more than vegetables, relaxation or beauty. Mrs. Hammond is a young 4-H nutritionist associated with the University of Illinois Cooperative Extension Service in Chicago. She is the mainstay of a 4-H community gardening project on the grounds of the Robert Taylor housing project on the south side of Chicago. This huge project of high-rise buildings, Mrs. Hammond explains, houses 27,000 people, 20,000 of them children. Most of the families are on welfare. "A $70 million flop," she calls it.

The worries and the cares of the day for Robert Taylor residents are muggings, elevator rapes, people falling or being pushed down elevator shafts or, until recently, from the open balconies on each floor. The balconies are now barred, making the project look even more like a penitentiary.

"People are afraid; they lead a taut life," Mrs. Hammond says. "I am afraid every day, but I mix my faith in people with my fear, and I go on."

"Going on" means trying to get more community gardens started in the Robert Taylor project. There were two in 1973.

"When I came here," Mrs. Hammond recalls, "I began to work with the 4-H program on nutrition. Working with the children, I found they were interested in growing things. They became so interested they started digging up the area. I went to the Chicago Housing Authority. They kind of gave me a hard time. But I got some support and I convinced them we should have a program.

"They wished me luck, patted me on the back, and sent me off. But they were surprised and proud to see how well we did. We made flower planters out of old tires and the idea spread all over the city.

A Harvest Moon Festival

"Last summer we had a complete program centered on the vegetable gardens. We had a Harvest Moon Festival; no meat, but good vegetables. We cooked them and people ate them. We had cooking, canning and freezing demonstrations." Mrs. Hammond finds that the vegetables grown at the Robert Taylor houses help with family food expenses: "Gardening has so much to offer. And they learn so much, working with living things."

Mrs. Hammond's volunteer assistants, women who live in the Robert Taylor Homes, and whose children are involved in the gardening work, fairly burst with enthusiasm for the gardens. "The kids were so excited about it," says one. "They never saw greens grow. And then everybody wanted to get in on the greens."

Another reports, "We were surprised about the vegetables not being taken. Everybody would go by the gardens and say how beautiful they were."

"This is a constructive thing," says a third. "It is a way to be creative and to release the children's energies. Even the larger boys want to help. If we had space and the equipment, everybody in Robert Taylor would be gardening." This summer there are 13 gardens at the Robert Taylor project, and the Chicago Housing Authority is sponsoring them.

Gardeners' reactions as described by Mrs. Hammond and Mrs. Olson are of urgent interest to Charles A. Lewis, horticulturist at the Morton Arboretum in suburban Chicago. Lewis is studying these effects at

Washington. Youthful gardeners stand proudly by their individual plots at the Twin Oaks Garden Center. More than 1,000 children are gardening at 48 places, including a major site at the National Arboretum.

first hand wherever he can, urging that basic research be done.

Lewis has concluded that gardening by inner-city people, particularly the disadvantaged, can help them achieve a positive self-appraisal. Hence, in their interactions, they will not act out negative feelings, but positive ones. "There is a benefit in this kind of intimate involvement with plants," says Lewis, "that is particularly effective in dealing with human stress." Writing in *American Horticulturist*, Lewis asks: "What are the subjective values found in a ghetto garden?" and answers: "Into a life-negating urban situation are introduced the life-enhancing qualities of plants and gardens . . . we can see that there are indeed sociological, psychological, and spiritual implications in gardening. When fully understood in these terms, it becomes a potent tool for human improvement in untold areas. This is the new face of horticulture."

Lewis' enthusiasm is as personal as it is infectious. Turning to a visitor in his offices at the Arboretum recently, he remarked with an almost-surprised look on his face: "Here I've been in horticulture all my life. And to discover that it can be important and exciting. . . ." He did not need to complete his remark.

Or, as Mrs. Hammond says: "Last year we saw pride in young children. Something beautiful happened."

New York. Jo Conrad examines the first strawberries of the season in a Greenwich Village garden and recycling center. The hospital which owns the site does not charge the gardeners any rental fees.

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●

In both tours the large group will be divided into seminar groups and will be under the leadership of skilled interpreters and guides.

Something different: Until the present, Smithsonian Associates have been eligible for Domestic or Foreign Study Tours. For the listing of these tours see page 95. These tours by their very nature have had to be restricted in numbers; they are highly specialized, custom tours taking people behind the scenes and giving them a chance to pursue in depth their particular interest, whether archaeology in Afghanistan or Orthodox monasteries in Romania.

The new tours have been created to accommodate more people but at a lower cost, yet they are specifically designed with the Smithsonian Associates in mind: people who see travel as a way to broaden their mental and cultural horizons, who see travel, as an integral part of their education. In a word, these trips are a mini Grand Tour, country by country.

These first tours will be to Great Britain and Russia: the former because of its close association with our own country; the latter because of its exotic interest as an alternate society.

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Book reviews

Paine
David Freeman Hawke
(Harper & Row, $15)
Rebel! A Biography of Tom Paine
Samuel Edwards
(Praeger, $9.95)

In an age of angry and articulate Americans from Samuel Adams in Massachusetts to Patrick Henry in Virginia, none equaled Tom Paine for clarity and persuasiveness as a propagandist and polemicist of the Revolutionary cause.

After failing as a businessman in London, the 37-year-old Paine came to America in 1774, bearing letters of introduction from Benjamin Franklin. Just a little more than a year later, after the clash at Lexington and Concord that made him an instant patriot, Paine wrote *Common Sense,* a call to arms during "the times that try men's souls" that rallied the fence-sitters to rebellion. Living in Philadelphia, within the shadow of the Continental Congress, Paine quickly became the friend of his fellow revolutionaries—Washington, both Adamses, Jefferson, Franklin, Madison and Rush—and served them and the Colonies with his pen and as secretary to the Committee for Foreign Affairs during the war.

But Paine was not a politician, and when the war was over he had no constituency. After brief service on a loan commission to France, he returned to Europe in 1787 to sell his plan for a single-arch iron bridge. Though he again had no commercial success, Paine was lionized by the future leaders of the French Revolution. In London, he received the same treatment until he published *The Rights of Man,* which exhorted the people to overthrow the monarchy by revolution.

Shortly before he was indicted for sedition in England, Paine left for France to accept a seat in the National Convention and appointment to a committee to write the new constitution. Never in favor of terrorism or mob rule, Paine was himself imprisoned for almost a year during the Reign of Terror. Freed through the efforts of the newly appointed American minister, James Monroe, Paine was a sick and bitter man, consumed with hatred against those he took to be his enemies, principally George Washington, whom he publicly condemned for not demanding his release from prison as an American citizen.

Finally, in 1802, his dream of a French republic destroyed by the reality of Napoleon, Paine returned to America, a revolutionary manqué, prone to excessive drinking, arrogant and quarrelsome. Expecting the adulation of a grateful people, he was castigated for his scurrilous attacks on Washington and was publicly scorned as an atheist. Paine spent his last years in New York City and on his New Rochelle farm, attacking the Federalists in a steady stream of essays. He died in 1809, his passing unremarked save by the man who raided his grave and took his remains to England hoping to exhibit them for profit.

Authors Hawke and Edwards tell substantially the same tale. Both use historical sources and extracts from contemporary letters, but where Hawke substantiates the text with more than 50 pages of footnotes, Edwards offers none.

Rebel! is written by a storyteller and popular biographer, *Paine* by a chronicler and history professor who assumes the reader is familiar with the times in which Paine lived. Edwards' sweeping generalizations, his frequent references to Paine's sex life or absence thereof, and his flippancy with chapter titles (New Rochelle was not "Forty-five Minutes from Broadway" when Paine lived there) may put off the serious reader. Hawke, pedestrian in style, includes many more details of Paine's life in his longer work and is more inclined than Edwards to let the reader form his own judgments from the material presented.

—Barbara S. Kraft
Co-author of *In the Minds and Hearts of the People: Prologue to the American Revolution: 1760-1774*

The Great Houses of San Francisco
Text by Thomas Aidala
Photographs by Curt Bruce
(Knopf, $12.95)

"San Francisco has, from the beginning," writes Thomas Aidala, "captured the imagination of the country and the world as a place where our private myths might be made manifest and where eccentricity is not only grudgingly accepted but also expected." Houses and buildings, the subject of the more than 200 photographs by Curt Bruce, are the major contributors to the special and unmistakable flavor of San Francisco. Fearing that increased urbanization will alter or destroy the particular city of which these structures are the physical expression, *The Great Houses of San Francisco* is an attempt to "freeze the flow of time" so that others can "experience that dream."

In his text, architect and urban planner Aidala provides an interesting encapsulated urban history of San Francisco. The focus is naturally on the phenomenal growth in the decades following the gold rush of the 1850s, when San Francisco's wealth made it the commercial and cultural capital of the West. While the book is not intended as a scholarly architectural study, the wide range of styles and their sources are discussed in some detail; the treatment of the theories and controversies of late 19th-century and early 20th-century American architecture is both sensitive and intelligent.

The fact that San Francisco's builders, in creating "architecture-as-fruit-salad," experienced no moral dilemma in employing Italianate, Eastlake, French Second Empire, or even Egyptian and Moorish details for their wooden houses, speaks of a city that did not take itself "so seriously as to forget how to smile." While the multimillion-dollar mansions of railroad magnates Charles Crocker and Mark Hopkins (where the crystal chandeliers and Brussels carpets extended even to the stables) were lost in the earthquake of 1906, the stylistic freedom and variety of the houses that remain constitute a vernacular tradition that represents what is best in U.S. architecture.

Given San Francisco's growth in recent years, it is amazing that so much of the city's 19th-century past is intact. Curt Bruce's photographs (along with several 1890s vintage interior views) illustrate both the domestic character and the incredible richness of the city's physical heritage. While only a few of the straightforward, almost spartan, pictures show the buildings in an overall streetscape, the treatment of the houses as individual and isolated subjects produces photographs that are works of art in themselves.

When the occasional old building is shown silhouetted against the new skyline, the comparisons are far from flattering to the showpieces of contemporary San Francisco; the older Columbus Tower or the Hobart Building, when contrasted with neighbors like the futuristic Transamerica Pyramid and the Wells Fargo Bank Main Office, exhibit their builders' love of detail, surface texture and whimsy, while the modern structures have all the charm of giant computer punch cards.

The closing photographs of a bulldozer reducing one of these delightful dwellings to rubble give dramatic emphasis to the plea voiced in the Epilogue for the retention of these buildings as vital and active components of the city. If the destruction continues, the documentary aspect of this very handsome book will assume added significance. But *The Great Houses of San Francisco,* in

Victorian Columbus Tower is dwarfed by the sleek new Transamerica Pyramid.

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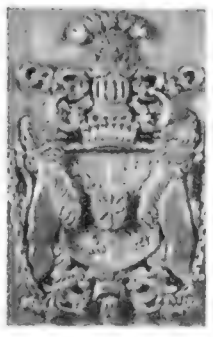

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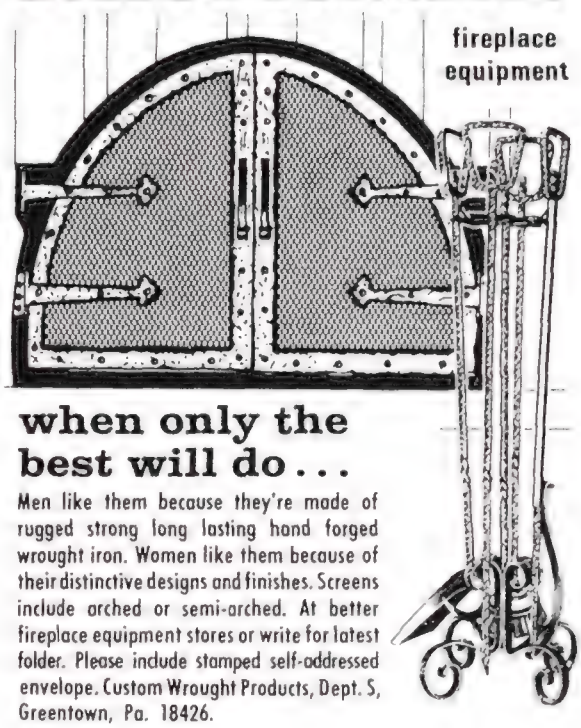

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—*William Morgan*
Department of Art and Archaeology,
Princeton University

Our World in Space
Text by Isaac Asimov
Paintings by Robert McCall
(New York Graphic Society, $19.95)

In the year 1497, five years after Columbus' discovery voyage, could anyone have predicted the pattern of future exploration, colonization and progress on Earth up to, say, 1997? In the year 1974 can anyone predict the pattern of future exploration, colonization and progress of earth people in the universe up to, say, 2474? In *Our World in Space* Robert McCall and Isaac Asimov try.

The book is well organized, starting with brief descriptions of the solar system, the universe, and the history of rocket vehicles and space exploration. It then progresses through increasingly speculative treatments on further travel to the moon, the nearby planets, the outer planets and, finally, the stars.

Long before the end, reality is left far behind and we are treated to an orgy of plausible but unbounded speculation, touching on subjects such as the possible evolution of the present human race into races of high-, low- and zero-gravity people, the colonization of the interiors of the asteroids, and the development of space arks from which zero-gravity people will colonize the universe.

Each chapter of Asimov's text is followed by a section of McCall's sketches and paintings on the same general theme. The author and artist seem to be aiming at a lay readership; however, they generally present enough facts for the serious reader. Asimov's perspectives on events past and present, as well as his speculations on the future, are scientifically based, if sometimes farfetched. Of McCall's nearly 100 illustrations, most make good use of color and form.

The book, although just published, reads in the spirit of five to seven years ago. It has an expanding, optimistic attitude instead of the feeling of today's dollar-conscious, sharply curtailed post-Apollo space program. Things haven't changed much since Columbus; he didn't fare too well either in the aftermath of discovery. We earthlings have a demonstrated reluctance to back exploration for long, unless a well defined payoff appears fairly soon.

Asimov tries hard to speculate on the potential payoffs of space shuttles, lunar, Martian and asteroid colonization, Jupiter exploration, and so on, but if history is any teacher, the major benefits of space exploration and colonization may be impossible to predict. Moreover, they may not accrue to earthlings any more than the benefits of Western Hemisphere colonization now accrue to Spaniards.

The book deals interestingly with the conservation needs of space-borne ecologies and the pragmatic considerations of obtaining enough energy, supplies and basic chemicals (like water and oxygen) for a space colony or a space ark. Yet these considerations reflect earthward with equal impact, and so the authors explain how we should be managing the resources of the "Spaceship Earth" and controlling its population.

Our World in Space is recommended as an introduction to the history and potential future of space travel, and as a mind-expanding source of illustrations of past, present and possible future vehicles,

Smithsonian Institution Offers Aviation Relic

The famous Douglas World Cruiser #2, "Chicago," which made the first round-the-world flight in 1924, has been restored and is presently on display at the National Air and Space Museum. In restoring this fine old aircraft it was necessary to replace the torn and deteriorated original fabric which covered the wings, fuselage and tail sections. Rather than destroy this historic fabric, it is being offered to the public on a first come, first served basis.

A square of fabric approximately 2″ X 2″ has been cut from the best portions of the "Chicago's" discarded skin and mounted on a handsome 15″ X 20″ poster under a colored print of the "Chicago" and her sister ships, the "New Orleans," the "Seattle" and the "Boston."

The National Air and Space Museum makes this valuable piece of history available to the public in time for the 50th anniversary of the "Chicago's" history making flight.

This will be the first of a series, and will be issued in a limited quantity. Worthy of framing, a highlight of any aviation collection, the ideal gift for the aviation enthusiast, this historic poster is not to be missed.

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—*Melvin B. Zisfein*
Deputy Director of the Smithsonian's
National Air and Space Museum

The Porpoise Watcher
Kenneth S. Norris
(Norton, $7.95)

This is the personal story of a man who never lost his childhood fascination with wild animals and for adventure. Now Director of the Coastal Marine Laboratory, University of California at Santa Cruz, he looks back on more than 20 years' study of porpoises in captivity and in the open sea. He was the first curator of Marineland of the Pacific, which opened near Los Angeles in 1954, and he later helped to design Sea Life Park on Oahu Island and Sea World in San Diego.

Two themes dominate his book: the development of successful oceanariums and the development of procedures which now enable zoologists to penetrate, and begin to understand, the ecosystems of the smaller cetaceans. Some readers may feel that he spends too many words on his inventions. Not so. Without the aid of electronic and hydrodynamic gadgets, there is simply no way to cross the border between man's world on dry land and the porpoise's world, which is fluid, three-dimensional, cool and salty. Among the novel techniques described are head-netting (the capture of porpoises as they play at the bow of a ship), speed-testing (clocking a trained animal racing for a reward), and depth-testing (inducing an animal to dive to the end of a measuring tape in the open sea).

Wisely concluding that a porpoise is best studied in the wild on its own terms, Norris invented a weird undersea sled, towed behind a motorboat, in which an observer could crouch in a Plexiglas bubble and spy on porpoises swimming alongside him. Again, the author and companions built an observatory on the edge of a cliff on the Kona coast where they could peer deep into the clear waters of a little bay frequented by porpoises. Thus they were able to record the 24-hour procession of events in the lives of undisturbed animals.

From the beginning of his interest in porpoises, Norris has been drawn by the mystery of their communication system and their incessant probing of their environment. Where exactly, he is trying to discover, are their transmitters and receptors of sound? (He sees little point in trying to perfect a dictionary of porpoise "talk" in the human sense.)

The book contains moving passages, as when Norris puts his hand in the soft mouth of a newborn gray whale, stranded on a Mexican beach, to find out how a lipless creature can suckle. Another time, he sees a pilot whale—presumably a bereaved mother—carrying the decomposed and tattered corpse of her baby.

In a final chapter Norris touches on the morality of killing cetaceans for commerce: "I say support those who fight for a ban on the killing of marine mammals, but, equally important, support those who demand more knowledge of their basic biology as the essential first step in the fight for their nondestructive exploitation."

This book, and one by Forrest G. Wood, *Marine Mammals and Man: the Navy's Porpoises and Sea Lions* (Luce, 1973), are the best historical descriptions of the evolution of techniques for the study of small cetaceans.
—*Victor B. Scheffer*
Chairman, Marine Mammal Commission;
author of *The Year of the Whale*

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Smithsonian highlights

Museum of Natural History
Live ants, cockroaches, termites and spiders are among the delights of the Smithsonian "Insect Zoo." Visitors can observe biological aspects of the insects in natural, environmental settings.

"Jewelry Fit for a Queen" is a major exhibit of dazzling objects from historic to modern times (see SMITHSONIAN, June 1974). Included are Marie Antoinette's 36-carat diamond earrings, the silver-and-diamond tiara which was Napoleon Bonaparte's gift to his wife, a ring set with the finest emerald on display anywhere in the world, and Marjorie Merriweather Post's elaborately jeweled evening bag.

Anacostia Neighborhood Museum
"The Message Makers" is an examination of the decision-making process utilized in the media—radio, television, newspaper and film—in determining the selection of a message. Vital to the selection process are the influence and impact the message has on the lives of people in general and black people specifically. Included are Teletype and video-tape machines, newspaper clippings, films and slides—opens August 11.

National Portrait Gallery
The first major Smithsonian Bicentennial exhibition, "In the Minds and the Hearts of the People: Prologue to the American Revolution," documents the turmoil and discontent of the Colonies in the years preceding the Revolution. Eighteen Georgian settings of furniture and decorative items serve as display rooms for the documents and paintings by such artists as Charles Willson Peale, Sir Joshua Reynolds and Allan Ramsay.

Renwick Gallery
"Man-Made Mobile: The Western Saddle" is an exhibition of 20 saddles depicting the evolution of their design from the first saddles brought to the Western world by the Spanish conquistadores. Also included are slide shows and examples of the extension of the saddle idea into other seating forms such as those used on bicycles and tractors.

"The Goldsmith" is an exhibition of original handcrafted work selected from a recent competition among artists working in metal. Included are the jewelry, hollow ware, flatware and architectural and decorative accessories of 145 contemporary artists—through August 18.

National Collection of Fine Arts
A new installation featuring selections from the 20th-century collection illustrates the figurative tradition in painting of the last ten years. Supplemented by loans from other sources, the collection includes the works of Joe Shannon, Fritz Scholder and Billy Morrow Jackson—opens August 9.

The art of Horatio Shaw, a primitive painter of the late 19th century, is featured in an exhibition of 25 paintings and 10 drawings. Fresh, attractive landscapes and farm scenes are dominant among the Michigan artist's works—opens August 16.

Associates' Events
Join a geological survey of "Oak Hill" in Loudoun County, Virginia, led by Frederick Collier of the Smithsonian's Department of Paleobiology. In the formal gardens of "Oak Hill," James Monroe's home built under the direction of Thomas Jefferson in 1818, are numerous dinosaur fossils which were quarried on the property. A luncheon in Leesburg's Laurel Brigade Inn is included—August 4 or 25. For information on Associates' events and classes, call (202) 381-5157.

Parking on the Mall
Metro construction has made parking on the Mall near the Smithsonian complex extremely difficult. All parking prior to 10 A.M. is restricted. The use of public transportation is recommended. Write Associates' Reception Center, Smithsonian Institution, Washington, D.C. 20560 for current information.

Puppet Theater, Arts and Industries Building
The theater will be closed most of the month of August in preparation for a new show. "What If . . .?", a space fantasy, runs through August 4. For performance times and ticket information, call (202) 381-5395.

National Air and Space Museum, Arts and Industries Building
"Exhibition Flight" is a continuing exhibit demonstrating barnstorming, air racing and aerobatics with the Waco 9, Pitts Special, Turner Special and Bücker Jungmeister on display. Continuous films of air shows are featured in the grandstand theater.

Museum of History and Technology
"American Etchings" is a special exhibit in the third-floor Hall of Painting and Graphic Arts, featuring etchings of the 1880s—through September.

"California, The Golden Quest," located in the "Hall of Everyday Life in the American Past," features new exhibit cases on California's Gold Rush days. Included in the exhibit are the tiny nugget found at Sutter's Mill that triggered the prospecting race from six continents, newspaper accounts fanning the gold fever, and assorted trappings of miners from sifting pans to gold-weighing scales.

Contributing Memberships
Persons who contribute $50 or more annually to the Associates support the Institution's national educational programs and enjoy additional privileges. Graduated benefits include:
- Assistance in communicating with any part of the Smithsonian.
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- Research service for questions about subjects related to the Smithsonian.
- A remembrance from the Smithsonian in the form of a commemorative object or work of art. Write: Contributing Membership, Smithsonian Associates, Smithsonian Institution, SI 118, Washington, D.C. 20560.

Traveling Exhibition Service
There are up to 70 different Smithsonian-sponsored exhibitions on display each month throughout the United States and Canada. For a complete listing and information on how to bring an exhibit to your area, write: Traveling Exhibition Service, Smithsonian Institution, Washington, D.C. 20560.

- Logan, Kansas—"Kurt Kranz: Bauhaus & Today" (Dane G. Hansen Memorial Museum, August 3-September 1).
- Minneapolis, Minnesota—"Folk Paintings from Dalarna" (American Swedish Institute, August 17-September 15).
- Boulder, Colorado—"Molas from the San Blas Islands" (UMC Fine Arts Center, University of Colorado, August 17-September 15).
- St. Louis, Missouri—"Eskimo Art" (Museum of Science and Natural History, August 3-September 1).
- Newark, Delaware—"Mississippi Folk Architecture" (University of Delaware, August 3-September 1).
- Little Rock, Arkansas—"The Nag Hammadi Codices" (University of Arkansas, August 17-September 15).
- Cortez, Colorado—"In Beauty It Is Begun" (Project Sun, August 17-Sept. 8).
- Dallas, Texas—"Man in Sport" (Dallas Public Library, August 17-September 15).
- Scranton, Pennsylvania—"Samit" (Everhart Museum, August 17-November 3).
- New Orleans, Lousiana—"The Magnificent West: American Heritage" (The Hibernia National Bank, August 10-September 8).
- Huntsville, Alabama—"Modern Housing Prototypes" (Huntsville Museum, August 3-September 1).

Smithsonian Commons
Located in the original Smithsonian Castle building, the Commons offers a buffet luncheon and salad bar from 11:30 A.M. to 2 P.M. ranging from $1.60 to $2.25. Also available are coffee and pastries from 10 to 11 A.M. An Associate card is required and members may experience a delay in seating during the summer season—open Monday through Friday.

Summer Museum Hours
The Arts and Industries, Air and Space, History and Technology and Natural History Buildings are open daily from 10 A.M. to 9 P.M. All other museum buildings close at 5:30 P.M.

Travel the Smithsonian way

You are part of the Smithsonian when you travel with other Associates on a Domestic or Foreign Study Tour. Whether your interest is geology, anthropology, natural history, folklore, archaeology, art, music, drama or architecture, there is a tour for you. You will be accompanied by Smithsonian curators or other experts and, where possible, taken behind the scenes of Smithsonian exhibits and research projects.

DOMESTIC STUDY TOURS

North Carolina Craft School—August 18-24: A week at John C. Campbell Folk School attending various classes and meeting with local artisans.

Iceland and Faroe Islands—August 17-31: Two weeks of exploration by air and sea from Reykjavik to Westman Islands, Latraberg and Akureyri, including a stop at the ancient site of the Althing; visit Faroe Islands and cross the Arctic Circle (depart and return New York).

Pacific Northwest—September 8-18: A visit to Expo '74 in Spokane, with emphasis on environmental exhibits, and a trip by motor coach to Mt. Baker, Grand Coulee Dam, Rocky Beach, Ginkgo Petrified Forest and Olympic National Park to study the story of the forests.

Williamsburg Weekend—September 19-22: A return to Colonial days as you meet members of the Williamsburg Foundation, explore the crafts and architecture, eat Colonial food and stay at the Williamsburg Inn.

All About Trains—October 9-13: A weekend in Washington, D.C., visiting the Smithsonian's Halls of Transportation; ride the Metroliner to Baltimore, and take a steam engine ride from there over the historic route to Ellicott City. Trip includes a day in Harper's Ferry.

All About Antiques—October 12-19: In the spectacular setting of Connecticut fall colors, accompany an expert to see the fine antiques in New Haven, Wethersfield, Farmington, Hartford, Litchfield and Woodbury.

FOREIGN STUDY TOURS

Black Sea Cruise—September 18-October 6: Depart and return Athens, via Turkey, Bulgaria, Romania and Russia.

Afghanistan and Pakistan—October 20-November 16: Archaeological and historic sites (waiting list only).

Egypt and Ethiopia—January 4-26, 1975: Ancient Arabic monuments and sites in Cairo, Luxor, Aswan, Aksum, Lalibela and Addis Ababa.

Ancient Sites of the Maya—January 11-30, 1975: *Argonaut* yacht cruise from Montego Bay to British Honduras, Guatemala and Yucatán. Return by air via Mexico City.

Australia and New Zealand—March 14-April 8, 1975: Flora, fauna and anthropology, via Tahiti and Fiji.

Northern Spain and Southern France—May 13-June 4, 1975: Cave paintings and the art of Paleolithic man.

Classical Greece—June 10-July 2, 1975: Famous historic sites in central Greece and the Peloponnesus.

Copenhagen to Lisbon—August 23-September 14, 1975: Cruise on the *Argonaut*, with stops at major European ports.

Russia—September 25-October 17, 1975: Soviet art and architecture.

Hawaiian Islands—November 8-21, 1975: Petroglyphs and natural history.

For information on specific domestic tours, write Mrs. Rosa Mae Howe, Domestic Tours, Room SI 106; for information on specific foreign tours, write Miss Bliss Schumann, Foreign Tours, Room SI 123, both at Smithsonian Institution, Washington, D.C. 20560.

By Patrick Ryan

Tracking down those 'lost' office supplies

Office laborers the world over should mark well the warning implicit in a recent report from the British Industry Security Association. "Many office workers," it revealed, "regard access to office supplies for their own personal use as a 'perk' of their job," with a resultant loss across the country through staff pilfering of stationery oddments estimated at more than $25 million a year. Items that have gone missing in this manner range from pencils and paper clips up to typewriters and tape recorders. The association's particular survey of a sample of London office buildings suggested that on the average they lost more than one percent of their office supplies to light-fingered employees every year.

As an old office hand from way back with callouses on both typing fingers, I was surprised that internal purloining accounted for only one percent. My skepticism was later supported by a personal opinion poll which I conducted among veteran clinical toilers in adjacent monoliths. They unanimously considered that the investigators would have been nearer the truth if they had reversed their findings. It seems to us that only about one percent of any firm's stationery requisites is used on its behalf, while the other 99 percent is filched for the domestic requirements of its devoted personnel.

I would like to be able to assist the industrial security sleuths in tracking down such major missing items of office equipment as minicomputers and photocopying machines. But, destined as I am to be but one of life's spear-carriers, all I can help them with is the Case of the Missing Paper Clips.

I can, however, emphasize how ill-considered it is to regard this humble but tenacious device as inferior to such products as the wheel, the plough or the thermonuclear bomb. These inventions have only been used for limited purposes: respectively, rolling along, turning the sod or disintegrating people. The humble yet noble paper clip, on the other hand, is an artifact of many parts.

The paper clip (originally a fastener fashioned from wax and ribbon) is said to have been invented in the 13th century. Although the bent-wire device we know is a relatively recent improvement, the essential idea remains much the same as when it might have been used by Roger Bacon to keep his scientific papers in order, or by William Caxton to hold his sheets of press copy. But this application represents only one paper clip use.

In Munich, a few years ago, a manufacturing firm became puzzled by the apparently insatiable appetite of its staff for paper clips and conducted an investigation into the life and death of a controlled consignment of 100,000. The detective team, bleary-eyed from peering into files for their quarry, finally reported that only 20,000 clips, or 25 percent of the total, had actually been used for attaching one or more sheets of paper to another. Of the other 80,000, 19,413 had become chips for card players, 15,842 were tissue-topped as typewriter cleaners, 14,163 were twisted into horrific shapes during telephone conversations, 7,212 were intimately employed in keeping ladies' stockings up, 5,434 served as primitive toothpicks, 3,196 as pipe cleaners, 5,309 as manicure tools, 2,431 as screw tighteners, and the outstanding 7,000 just couldn't be located anywhere. Probably they had been fired into the wild blue yonder by underworked executives toying with rubber-band catapults.

From this investigation, it would seem that the nimble-fingered 13th-century lady or gent who invented the concept greatly underestimated its potential in simply calling it a paper clip. Since it spends only 25 percent of its time obedient to its name, justice might have been done to its versatility if it had been marketed as the Universal Emergency Kit.

A handful of these all-purpose knick-knacks, together with a mouthful of chewing gum and a fair length of string, might well come in handy at the End of the World, and might also prove profitable in the hereafter. If you go to Paradise, a paper clip would be appreciated by St. Peter for picking celestial fluff out of the lock on the golden gates. And if you go down below, a couple might win you powerful friends if offered to the Devil for keeping the satanic curls in his mustachio. Straightened out a bit, paper clips would certainly serve for digging hot cinders out from under your toenails.

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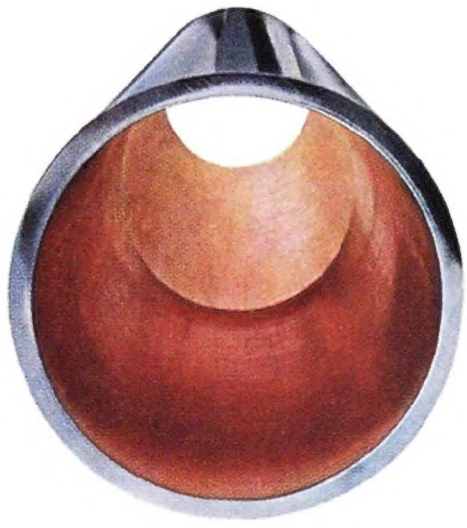

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